Applied Hydraulics

PNEUMATICS · ELECTRICAL CONTROLS

JUNE/1957

MODIFIED VALVE SPOOLS

...to control and eliminate cylinder drift

PAGE 65

STEVENS RICE
UNIVERSITY MICROFILMS
313 N. FIRST ST.
ANN ARBOR, MICH.

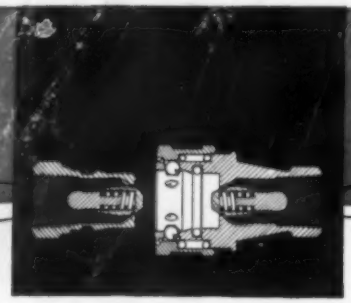
FC FRANCHISE CIRCULATION

THE MAGAZINE OF FLUID POWER

CONTEST CLOSING DATE
JULY 1st, 1957
For complete details, see page 52

Coming in the AUGUST issue
a special report about
TEMPERATURE CONTROL IN HYDRAULIC SYSTEMS
See page 14

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE



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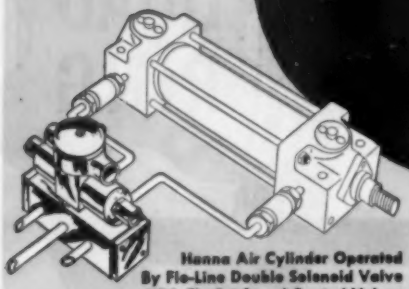

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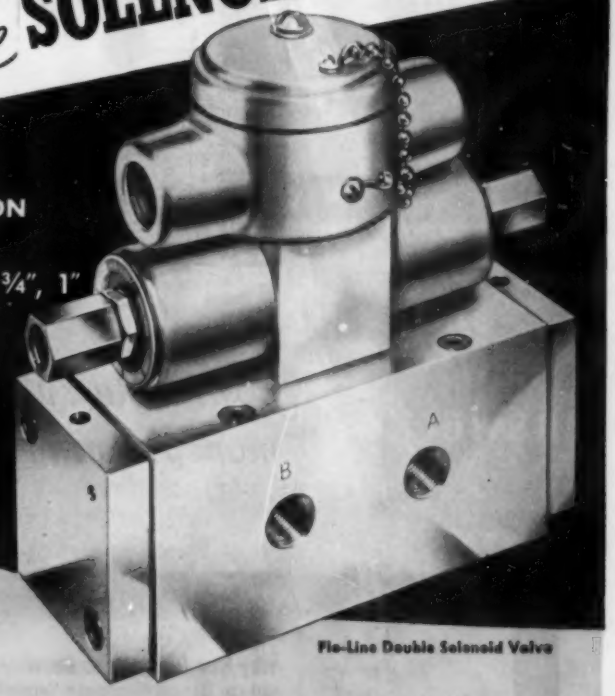

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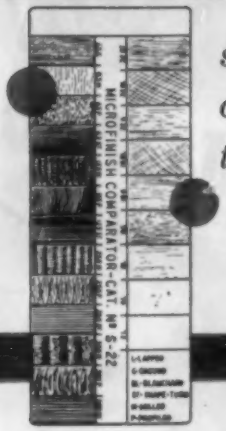

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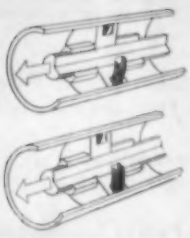

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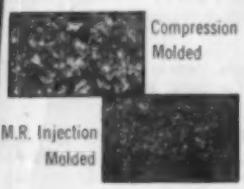

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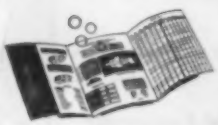

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Applied Hydraulics

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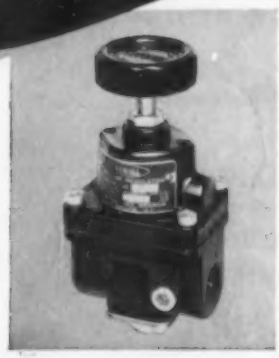

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THE MAGAZINE OF FLUID POWER

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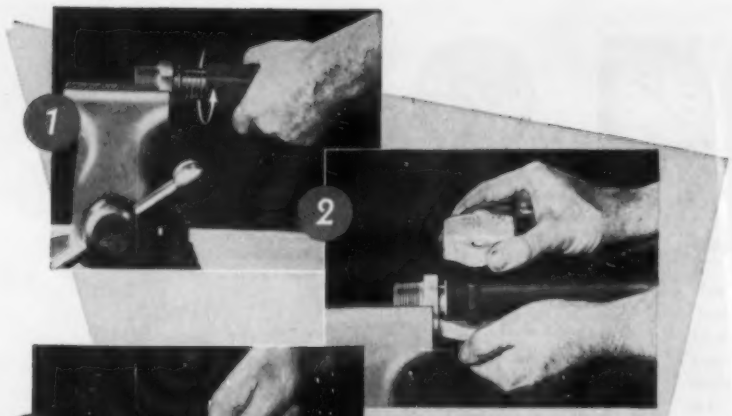

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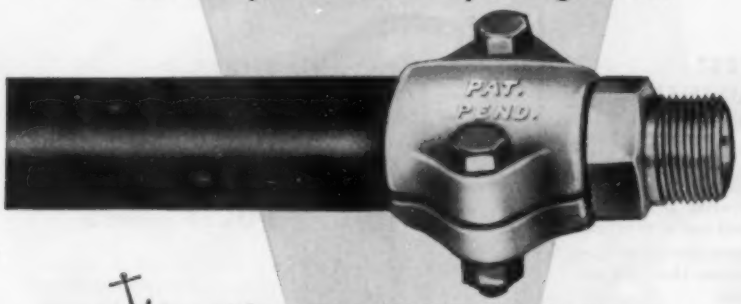

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Also described are Anchor Reusable Couplings which include the commercial Duloc Couplings for QW and QWR Hose and Anchor Standard Reusable Couplings with 2-Wire Braid Hose for high pressures, with 1-Wire Braid Hose, Hi-Burst and Standard 2-Rayon Braid Hose for medium and low pressures.

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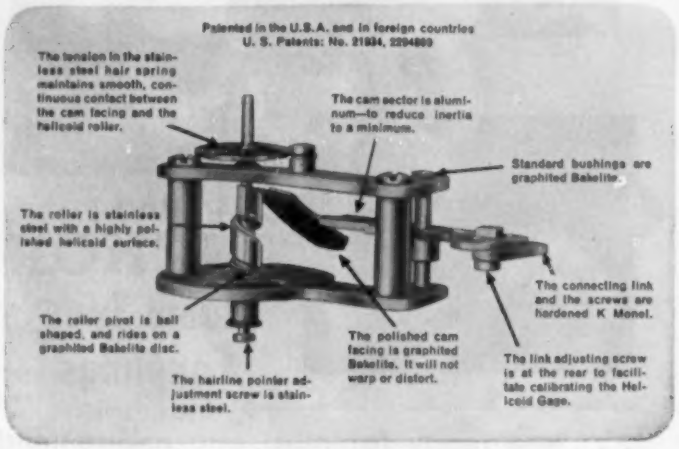
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Fluid Power Lines

about Applied Hydraulics

DRIFTING ALONG . . . Lazy summer days are coming, and even the efficiency boys will be lolling on the lakes with an unbaited hook. But machines have no seasons, and to prevent such drifting in cylinders, this month's cover article shows several ways of modifying valve spools. Cylinder drift results from the inherent leakage past the lands of a spool valve. In many applications even a small movement cannot be tolerated, because of the precise location of limit switches or feedback devices on servo systems.

Because drifting is caused by the differential force built up when pressure due to leakage is applied to each side of the piston, the answer would seem to be—connect both sylinder ports to tank to prevent pressure build up. However, this would mean the cylinder floats and offers no locking effect. Making these connections through orifices formed by slotting the valve spool insures the deceleration and locking effect of the closed-center valve.

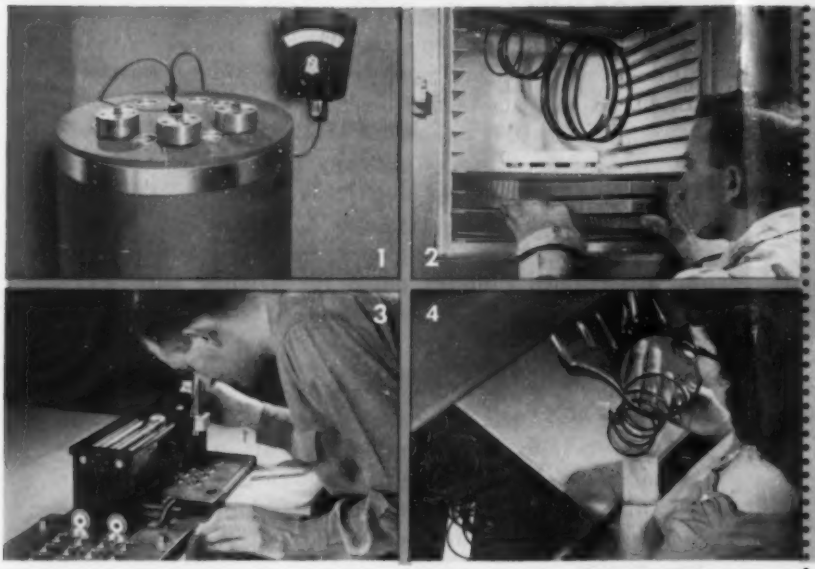
NEW FACES . . . We've got one. Like every other product, styling is important to a magazine, and a lot of time, ideas, talents, and arguments go into our front cover designs each month. To make a more attractive appearance on your desk or drawing board, we've changed the way we write our name for a clearer presentation of who we are and what we do.

LEFT-HANDED WRENCH . . . Ever call up your hydraulic representative for a deceleration valve passing a maximum flow of about 8 gpm? Because no such valve was readily available, we had a story to tell about how a much larger valve had to be adapted to a machine built by Michigan Drill Head. Getting the valve to work without developing high surge pressures meant designing a cam which would quickly depress the valve to its effective position and then slowly close it for slow down and stop of an index table. Modifying the valve spool was also helpful where heavy loads were involved.

UP AND ATOM . . . Those working for the development of better fluid power equipment can be proud of the job that hydraulics is doing on a nuclear reactor for medical research. Two 21-ton shutters moving at 30 fpm control radiation for experimental radiotherapy. The problems of cylinder and pump selection are discussed on page 96.

WHAT'S "TENONING"? . . . We've used a word which isn't in the dictionary in the article describing air circuitry for woodworking machines, page 104. One machine cuts a slot—obviously it performs a slotting operation. The other machine cuts a tenon. So why not call the operation "tenoning"? We have the support of Norm Hope who designs much of the equipment at the Superior Sash plant in Toronto. Whatever you want to call it, you'll find the circuits quite interesting.

Precision certified specification "O" rings from compound 830-70...quality proved by all ASTM Tests



These controls, some of which are used exclusively at Precision, assure quality.

1 A Precision modification of this Aluminum Block Ager provides "O" ring tests up to 600° F. in many volatile fluids.

2 "O" rings are accurately checked for compression and high temperature resistance in this efficient oven.

3 This Precision developed Inspection Stage controls "O" ring molding to exacting tolerances.

4 Rigid inspection under shadow-free illumination assures highest quality.

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Write for Bulletin No. 130. Address Dept. AH-6.

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Fluid Power Lines continued

WHO'S ON FIRST? ... Keeping track of flow requirements for 14 cylinders can run into complications, and some kind of operating sequence must be written down. Harold Yarnell, of Surface Combustion, has a careful way of knowing just what is happening at all times in the heat treating furnaces he designs. Take a look at page 90 for his method of charting the duty cycle to determine pump requirements. Harold is very much concerned with emergency operation of his equipment and has designed his own air-operated booster pump for stand-by purposes. We'll report more on the design of this pump in a future article.

SAE MEETINGS ... A first-hand report on the Spring Meetings of the SAE aircraft committees appears in the Aircraft Section. Discussions at these meetings cover all phases of hydraulic and pneumatic component development and application, and many military specifications originate with these groups.

ON THE LEVEL ... A winch can be a life or death proposition on a military vehicle. As long as you can find a tree stump or other such immovable object, it can pull you out of the deepest mud. Along with the advantages of small size, simple control, and overload protection, a hydraulic system designed for this purpose provides a method of keeping the cable winding evenly on the drum. The reciprocating guide cylinder is servo controlled.

COTTON PICKIN' DESIGN ... Increasing production in processing cotton and synthetic fibers was a matter of increasing quantity of fiber built up on a *lap*. Applying air cylinders to a standard *picker* has accomplished greater lap weight without increasing volume. Use of diaphragm type cylinders for part of this design gave a short, high force stroke.

JULY IS FINISHED ... the AH issue, that is. We think we've put together a very valuable package of design ideas on fabricating machines—presses, benders, welders, and air tooling. These stories are concerned with problems of pre-filling, decompression, speed control, pressure compensation of pumps, and others common to this type of equipment. To preface this issue we'll have a complete report on the ideas discussed at the Vickers Fabricating Machine Conference which was held during the last week of May.

A PROBLEM
IN HYDRAULIC
CONTROL?

call the man from Webster

On America's leading tractors, Webster Hydraulic pumps have proven themselves a winner. They stand up better to such tough, demanding day after day abuse. When your hydraulic application calls for proven stamina to resist shock, with a reserve of quick response and compactness of overall design . . . be it for farm equipment or power shovels, then the man from Webster can help. Let him tell you about the complete Webster line of over 100 different positive displacement gear type pumps and fluid motors.

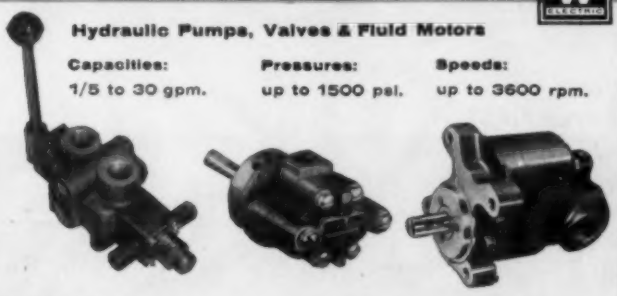
Write or call the man from Webster — a good man to have on your design team.

OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC
MELROSE 9-3511
RACINE · WIS

Hydraulic Pumps, Valves & Fluid Motors

Capacities:	Pressures:	Speeds:
1/5 to 30 gpm.	up to 1500 psi.	up to 3600 rpm.



FRANKLIN ADV. H102

☐ *Have THE MAN FROM WEBSTER contact us—*

- Please send the following -

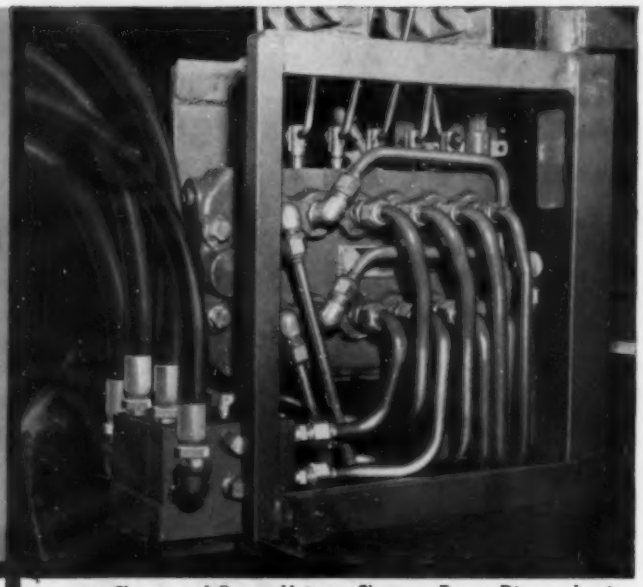
☐ *Complete hydraulic catalog of pumps and valves*

☐ *New information or data as published*

Name _____
Title _____
Company _____
Street _____
City _____ State _____

Circle 140 on Reader Service Card

FULL PAYLOAD POWER



Close-up of Power Unit on Sherman Power Digger showing direct power delivery from *lever to load*. Pilot model equipped with Eastman Hydraulic Hose and Tube Assemblies.

International Harvester Model 75 Payscraper. First application of hydraulic steering on earth movers. USER OF EASTMAN EQUIPMENT.

Allis-Chalmers Model 100 ALL CROP Harvester. Steering brakes and header height hydraulically operated. USER OF EASTMAN EQUIPMENT.

Bucyrus-Erie Model H-5 Hydrocrane. Hydraulically controlled boom, out riggers and bucket. USER OF EASTMAN EQUIPMENT.

FOR FULL PAYLOAD POWER FROM LEVER TO LOAD specify

Eastman

HYDRAULIC HOSE ASSEMBLIES

For full payload power—*from lever to load*—consistent with long-lasting service, safety and sound construction—always specify Eastman Hydraulic Hose Assemblies.

Eastman, *first in the field* of Hydraulic Hose Assemblies, developed many original engineering advantages in design, construction and assembly—time tested by *unequalled* years of experience.

Since Eastman pioneered in the very first applications of mobile hydraulic power . . . you will find Eastman Hydraulic Hose Assemblies used by many original equipment manufacturers who were pioneers in their respective fields also.

Let *their endorsement be your assurance* of the satisfactory hydraulic performance of your products, too—plus the prestige and competitive sales advantage that comes with quality Eastman Hydraulic Hose and Tube Assemblies—*the Standard of the Industry!*

It pays to write Eastman ***FIRST***... *because Eastman was first in the field of Hydraulic Hose Assemblies*

Eastman *first in the field* **MANUFACTURING COMPANY,** Dept. AH-6, MANITOWOC, WIS.

LETTERS to the editor

Address your letters to: Editor, APPLIED HYDRAULICS Magazine, 812 Huron Rd., Cleveland 15, Ohio.

Die Cast Valves

In your February issue you described an unusual application of die casting for hydraulic valves. Can you advise what method is used for removal of the cores in intricate interlocked positions in the valve body?

EDWARD G. VOLICK,
Design Engineer
Weston Hydraulics Co.
North Hollywood, Calif.

We suggest you contact the Char-Lynn Company direct. They may be willing to supply you with the information you require.

Hydraulics By Mail

In your April issue you stated you did not know of any correspondence course in hydraulics. Such a course is offered by the University of Wisconsin, University Extension Division. It is a correspondence course in elementary hydraulics. It is not a course in oil hydraulics.

LEONARD F. HILLIS
Associate Professor
of Civil Engineering
University of Wisconsin
University Extension Division
Madison, Wis.

JIC Symbols

Do you have available a reprint showing full coding symbols for standard valves, etc., in accord with the JIC standards? We would like to obtain twelve or fifteen copies of this reprint.

THOMAS E. ORR
D and O Engineering Co., Inc.
Wichita, Kansas

In the January 1957 issue we published a 32-page section of air and oil circuits. The first few pages of this section are devoted to detailed descriptions of the valve symbols. The rest of the section shows solutions to typical circuit

Continued on page 14

...another reason
why you can do the job faster, easier with a
GREENLEE No. 798-AC Hydraulic Power Pump

This *exclusive* new feature of the GREENLEE No. 798-AC Portable Power Pump . . . two-speed action for *fast approach* to the work and automatic change-over to lower speed, *high-pressure* . . . means big time savings for you. Eliminates costly waiting time for the ram to reach the work . . . makes jobs move fast! The compact *portable* GREENLEE electric motor-driven pump, illustrated, handles a wide variety of hydraulic power requirements wherever needed . . . either for tools in the field or for operating hydraulic rams, jacks, presses, and other systems in the plant or laboratory. Capable of developing continuous pressure of 6,000 psi and up to 10,000 psi intermittent pressure. Powered with ¾-hp constant-speed electric motor, 115- or 230-volt. Dimensions 19″ x 10″ x 12″; weight 63 lbs. Get facts now on how this new GREENLEE Power Pump can do a better, faster job for you.

Send Coupon Today

GREENLEE

GREENLEE TOOL CO.
2446 Herbert Avenue
ROCKFORD, ILLINOIS, U.S.A.

Greenlee Tool Co.
2446 Herbert Avenue, Rockford, Illinois

Please send data on the timesaving new GREENLEE No. 798-AC Portable Hydraulic Power Pump.

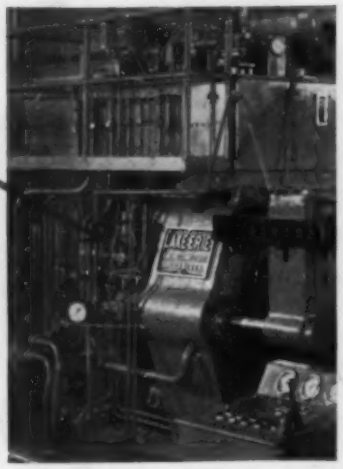
Name_____
Company_____
Address_____
City and State_____

Circle 47 on Reader Service Card

Memo to:

APPLIED HYDRAULICS READERS

WHAT'S THE TEMPERATURE HERE?



A special report in the August issue will give you the latest information about . . .

TEMPERATURE CONTROL in HYDRAULIC SYSTEMS

What's the effect of overheating on fluids? . . . on packings? What can the system designer do to assure safe operating temperatures? What types of coolers, heaters and controls are available?

NOTE TO ADVERTISERS: This special report is one of a continuing series prepared by AH's editors to help designers and users of fluid power to get maximum efficiency from their equipment. Your product advertising in APPLIED HYDRAULICS reaches over 25,000 men who can specify your product for their fluid powered equipment. Write us for more information.

CLOSING DATE FOR AUGUST ADVERTISING: JULY 5, 1957

APPLIED HYDRAULICS

The Magazine of Fluid Power

812 Huron Rd. • Cleveland 15, Ohio

LETTERS to the editor

problems. Copies of this section are available as a 32-page booklet, priced at 50 cents per copy.

No Differential

Referring to "Why Not Hydrostatics For Automobile Transmissions?" by Ian McNeil, your attention is called to Figure 1 and the description attached to the diagram. These two are further reinforced by the sentence at the bottom of page 85 stating "It should be noted that the arrangement in Figure 1 takes the fullest advantage of the differential effect of the piston rod areas in the two elements". It sure does!

In such a closed system both blank end areas must be larger than their respective rod end areas. Consequently, it is safe to assume that this "elementary form of hydraulic control" will not budge.

SANFORD ELLIS
George M. Pearse & Co.
Newark, N.J.

You are so right. The closed circuit shown in the sketch in the March issue won't operate unless some additional circuitry is supplied. Mr. McNeil's drawing was just a sketch and we should have made it clear that suitable valving would have to be added to allow fluid flow.

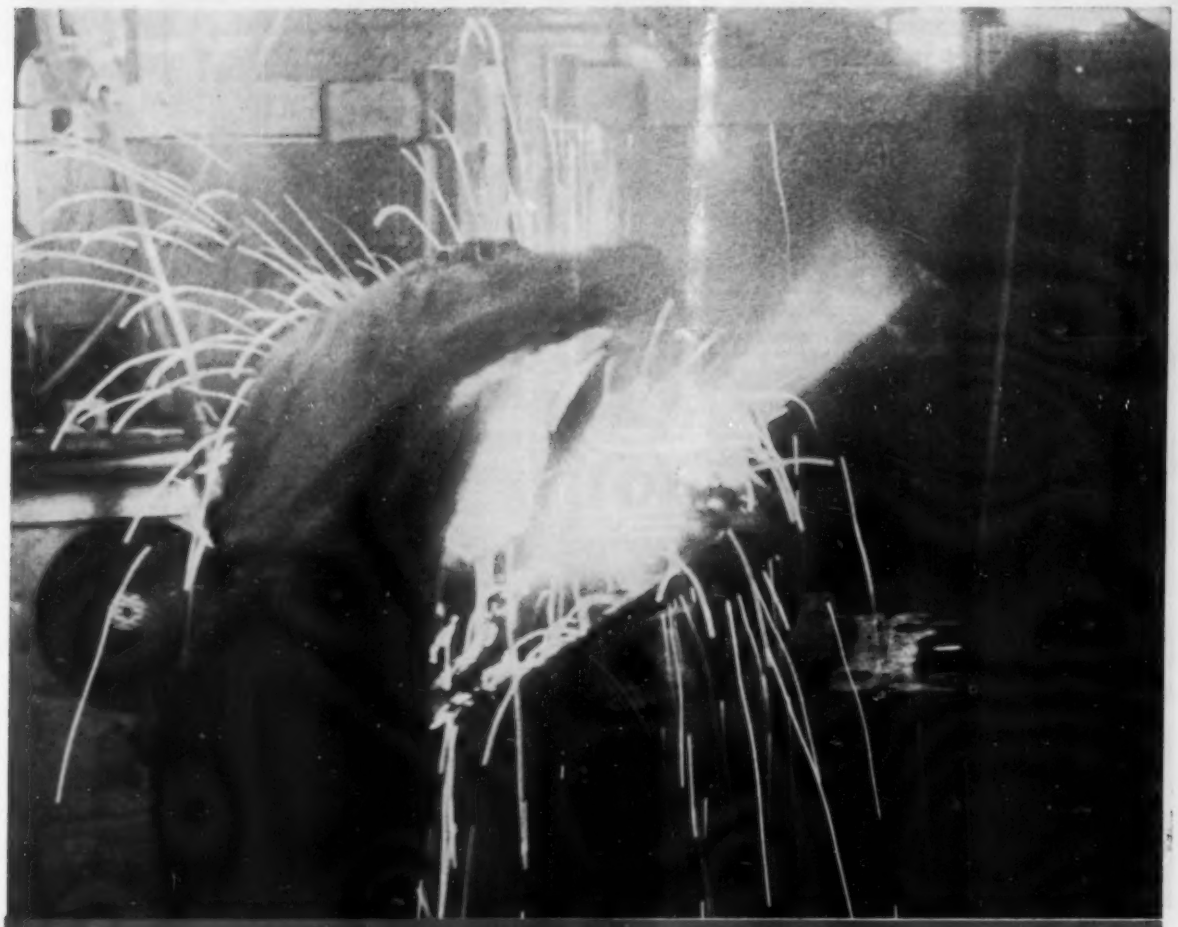
Fire-Resistant Fluids

We get frequent requests that our valves be packed specifically for one of the several fire-resistant hydraulic fluids. Selection of suitable packing is not too difficult if we can classify the fluid, which is usually referred to by trade name. We would like to know if there is a tabulation of these fluids available by trade name and classification.

R. S. PERRY
Chief Engineer
Valve & Fitting Dept.
Henry Vogt Machine Co.
Louisville, Ky.

This information has been forwarded. A breakdown of fire-re-

Continued on page 18



Houghto-Safe Needed Here

Let a leaking lift truck leave a pool of oil here. Let a pressure line break. Let a reservoir run over. Let just a welding spark go astray where hydraulic oil is free and . . .

Whoosh! You've got trouble on your hands.

We see it in the papers almost every day. People are still finding out about hydraulic fire hazards the hard way. Industry today is more safety conscious than ever before, yet you'll still find people who shake their heads with amazement when they hear the facts about hydraulic fire danger.

Under no more than normal working pressures, hydraulic fluid has sprayed as much as 75 feet—to touch off disastrous fires. Any piece of hydraulic machinery that ever comes this close to high temperature hazards—no matter how briefly or how seldom—can be a potential flamethrower.

But hydraulic fires need never happen. No matter what the hydraulic application, there's a Houghton Houghto-Safe fluid that will provide top-grade efficiency with complete fire safety. Ask your Houghton man.

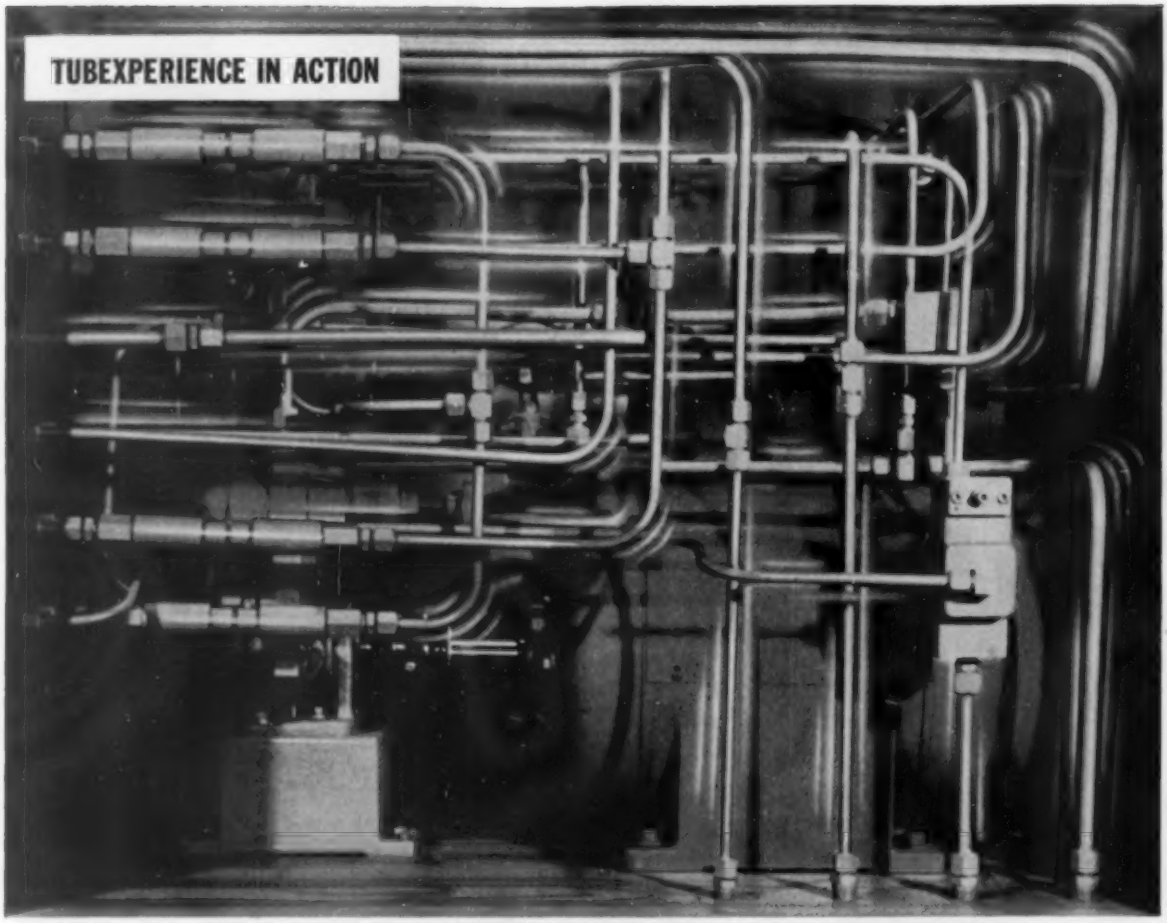
HOUGHTO-SAFE

. . . a product of

E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .



VIBRATION can murder hydraulic lines

Only tubing with high ductility and smooth, uniform surfaces can take this terrific punishment in its stride!

When big motors start delivering power, hydraulic lines go into their vibrating dance. Unless the lines are made from highly ductile material and have exceptionally smooth, uniform surfaces, the ceaseless, pounding vibration may actually cause cracks and ruptures.

Superior hydraulic tubing is available through leading warehouse distributors from coast to coast. Contact the one nearest you today for information—or get a free copy of Bulletin 39 by writing to Superior Tube Company, 2030 Germantown Ave., Norristown, Pa.

HERE'S WHY SUPERIOR (SAE) HYDRAULIC TUBING WILL GIVE YOU LONGER, MORE ECONOMICAL SERVICE

High ductility! *Furnished in dead-soft annealed temper, Superior hydraulic tubing flares easily, bends without pinching, can be readily fabricated for any hydraulic application.*

Non-aging steel! *All Superior hydraulic tubing is made of selected non-aging steel. It keeps its ductility, will not become brittle with age. Carbon content is limited to .12% maximum.*

Bright, smooth, clean! *Special processing gives Superior hydraulic tubing an unusually bright, smooth, clean finish on both OD and ID; reduces turbulence and pressure drop. Shipped with special rust preventive coating on both inside and outside surfaces.*

Fully tested! *And not mere random sample testing! Every length of Superior (SAE) hydraulic tubing is 100% hydrostatically tested at maximum working pressure—giving you realistic performance insurance.*

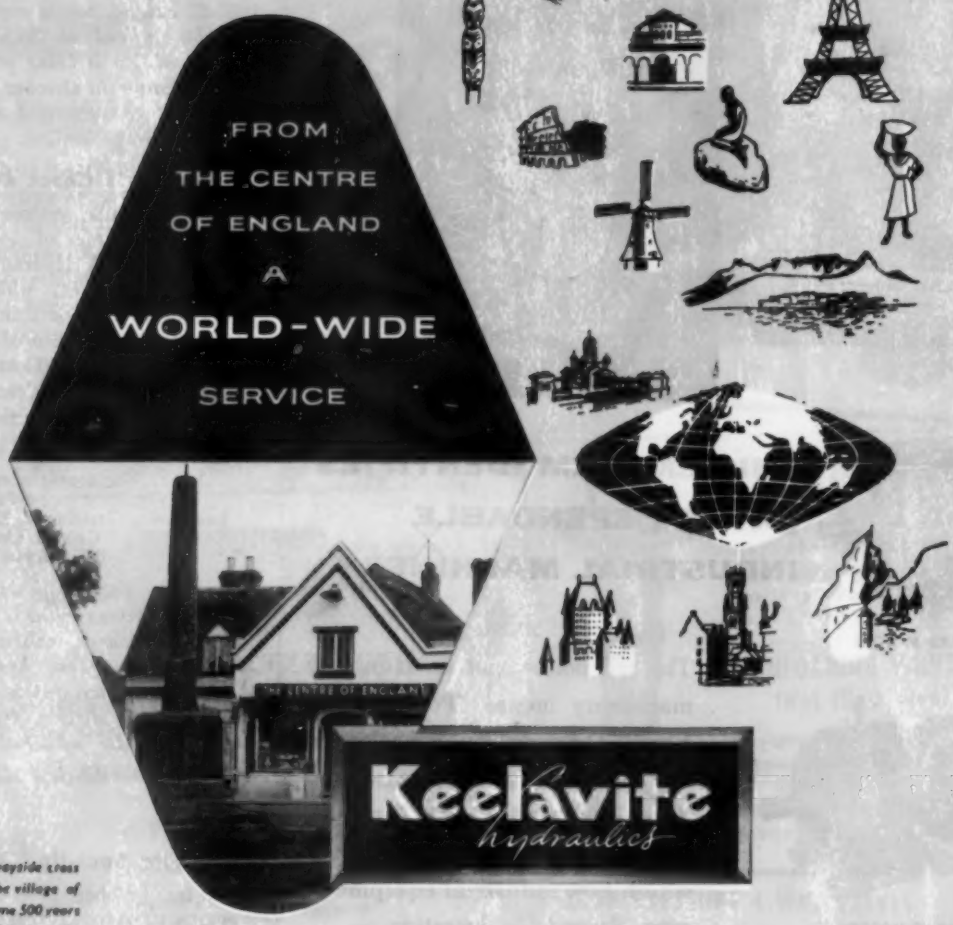
Superior Tube

The big name in small tubing

NORRISTOWN, PA.

All analyses .010 in. to ½ in. OD—certain analyses in light walls up to 2½ in. OD

West Coast: Pacific Tube Co., 5710 Smithway St., Los Angeles 22, Calif. • RAymond 3-1331



This ancient wayside cross has stood in the village of Meriden for some 500 years and by tradition marks the centre of England.

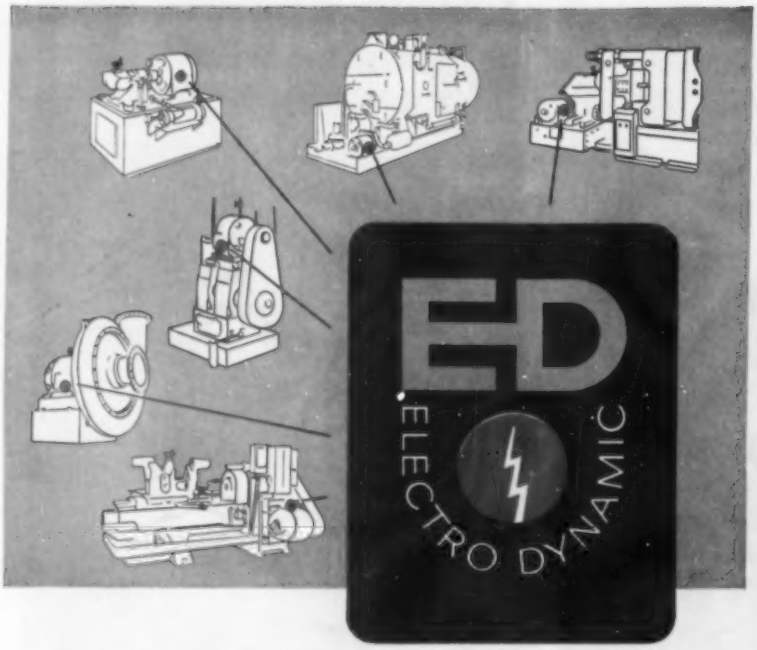
THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

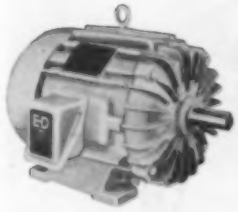
Write us for the name and address of your own Keelavite agent.

KEELAVITE
ROTARY PUMPS & MOTORS LTD.
ALLESLEY · COVENTRY · ENGLAND
Tel.: MERIDEN 441 Grams: KEELAVITE COVENTRY

Just one mile from the centre of England, is manufactured the complete range of Keelavite quality hydraulics. Circuit design and equipment installation services engineer these products into Keelavite hydraulic power transmissions renowned throughout World industry for their reliability, performance and economy.

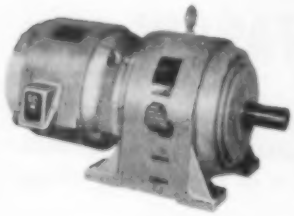
Canadian Agent: DYCON LIMITED, 25 CARSON ST., TORONTO 14, ONTARIO





STANDARD MOTORS

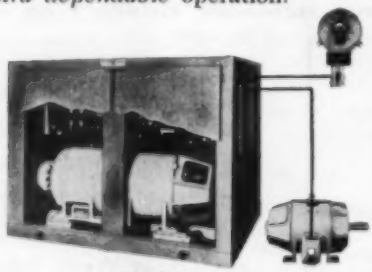
THIS EMBLEM IDENTIFIES EXTRA DEPENDABLE INDUSTRIAL MACHINERY



GEAR-ED-MOTORS

The red *power spot* on industrial machinery means "Powered by Electro Dynamic." Such machinery relies with confidence on the *extra dependability* of Electro Dynamic motors, the proven industrial motors which give industrial equipment *extra dependable* operation.

SELECTRON
VARIABLE-SPEED DRIVES



SELECTROL
VARIABLE-SPEED DRIVES

ELECTRO DYNAMIC
DIVISION OF GENERAL DYNAMICS
CORPORATION
BAYONNE, NEW JERSEY

LETTERS to the editor

sistant fluids is given in our FLUID POWER DIRECTORY . . . *Master Catalog of Fluid Power Products 1956-57 edition. Single copies are available, priced at* $6.50. *The 1958-59 edition is being prepared for publication in October of this year.*

Designer's Check List

We would like permission to reproduce portions of John W. Reed's article: A Hydraulic Designer's Check List, which appeared in your June 1956 issue. This material will be used in our Engineering Design Course for design and development engineers in our plants throughout the country.

ROBERT J. FELDHEIM,
Supervisor
Engineering Training & Education
General Electric Co.
Schenectady, N. Y.

You have our permission to reproduce portions of this article. Since your course deals with aircraft applications of hydraulics, you may be interested in George Keller's book: Aircraft Hydraulic Design, recently published by APPLIED HYDRAULICS. *Price per copy is* $4.50.

Delta Back-Up Ring

In the October 1956 issue of APPLIED HYDRAULICS there was an article entitled "Delta Backup Ring", developed by Northrop Aircraft, Inc. We have been unable to obtain the address of this firm, from the American Information Center in Sydney. Therefore, we would appreciate it if you would forward the enclosed letter to them.

F. JOHN LUDOWICI
Director
J. C. Ludowici & Son Ltd.
Sydney, Australia

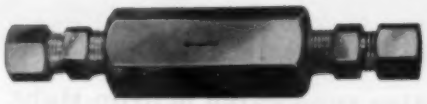
Your request for information has been forwarded to our Aviation Advisory Board member W. F. Talbot at Northrop Aircraft, Inc., 1001 E. Broadway, Hawthorne, Calif. ▼▼▼

SECO hydraulic VALVES IN STOCK

Simplex Engineering has had many years of experience in designing hydraulic circuits, and in building all types of hydraulic power and control systems. We have always used the most suitable components obtainable for each application – regardless of who the manufacturer might be. This we still do. Hence we well realize that there are many good *valves* of every type. We have, however, designed numerous valves for our own use – where there was evident a real need for lower cost, or greater simplicity, or the ability to perform at higher pressures. These valves we manufacture in quantity, *and carry in stock*. They are for sale "off the shelf".

SAFETY RELIEF VALVES

For limiting operating pressures. Six models—500 to 10,000 PSI—each adjustable within limits. Chatterless. Relief set by adjusting screw. Hooded, and provided with lock and key.



HIGH PRESSURE CHECK VALVES

Simple ball check passes flow in one direction only. Designed for pressures up to 10,000 PSI.

HANDWHEEL SET RELIEF VALVES

Ideal where quick and frequent adjustment of pressure is required. Three models – 1,000 to 6,000 PSI.

UNLOADING VALVES (Not Illustrated)

Designed to insure high pressure pump unloading at all times except at the interval when pressure is needed.

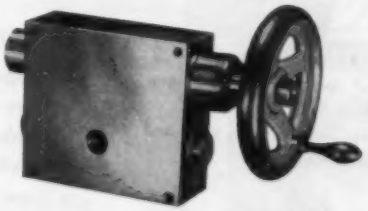
PILOT OPERATED CHECK VALVES

Basically a check valve, but allows free reverse flow when pilot pressure is applied. Seven models cover flow range of 6 to 100 GPM. Max. operating pressure 6,000 PSI.

PILOT OPERATED BLOCKING VALVES

Similar to valve described above except that pilot section is externally drained. For use where back pressure occurs in the inlet line. Models cover same range as Pilot Operated Check Valves.

HIGH PRESSURE 4-WAY VALVES



For manual control of many simple hydraulic circuits involving double-acting cylinders. Permits fine graduation of pressure and volume. Body is forged steel. Pressures up to 10,000 PSI.

If you use hydraulic valves you should have the SECO Catalog. Use the reader's service card.

SIMPLEX ENGINEERING CO.
ZANESVILLE, OHIO

NEW NICHOLSON *Model 300*

"4-way" control valve

Versatile flat-disc type valve is drop-tight . . . provides sensitive throttling action for a variety of rugged control applications.

If you need precise, repeatable control of double-acting cylinder-actuated mechanisms . . . you'll want to try this new advanced-design valve. Ruggedly constructed of a combination of corrosion-resistant materials, it can be used with air, water, gas and oil. Check its features, send for literature.

Send for your copy of new Bulletin 300 . . . for details on design, construction, sizes and applications.

Outstanding features:

- **Trapezoidal ports for modulated throttling.**
- **One-shot lubrication, reservoir in base.**
- **Leak-proof O-ring packing and seal.**
- **Easily adapted to single cylinder control.**
- **Low maintenance, easily disassembled.**
- **Simple, reversible mounting clamp and lugs.**

NICHOLSON

W. H. NICHOLSON and Company

VALVES • TRAPS • FLOATS • METAL PARTITIONS • LAUNDRY, DRY CLEANING, AND PRESSING MACHINERY • HOSPITAL CUBICLES

14 OREGON STREET, WILKES-BARRE, PA. • SALES AND ENGINEERING OFFICES IN 98 PRINCIPAL CITIES

Circle 83 on Reader Service Card

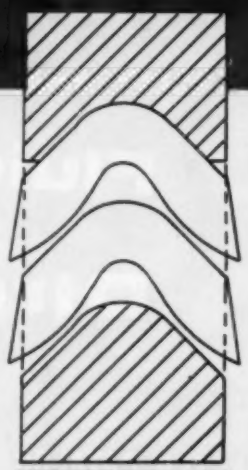
The Biggest Package in Packings!

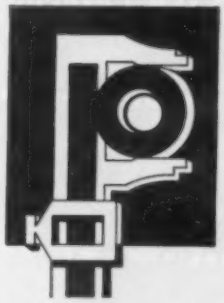
EXTRUSION-PROOF ADAPTORS

Periflex "Phenol-Fab" bearing type adaptors prevent extrusion and reduce machining costs by providing bearing surface where tolerance on parts is not held closely.

PRELOADED PRESSURE RINGS

Periflex molded duck and neoprene pressure rings with flared lips preload the packing recess without gland pressure and are endlessly molded.





Longer packing life and greater operating efficiency are both assured with this Periflex assembly widely used as rod or piston seal and preferred for proved ability to withstand high pressures and severe operating conditions.

Periflex • Inc.

HAZEL PARK
MICHIGAN

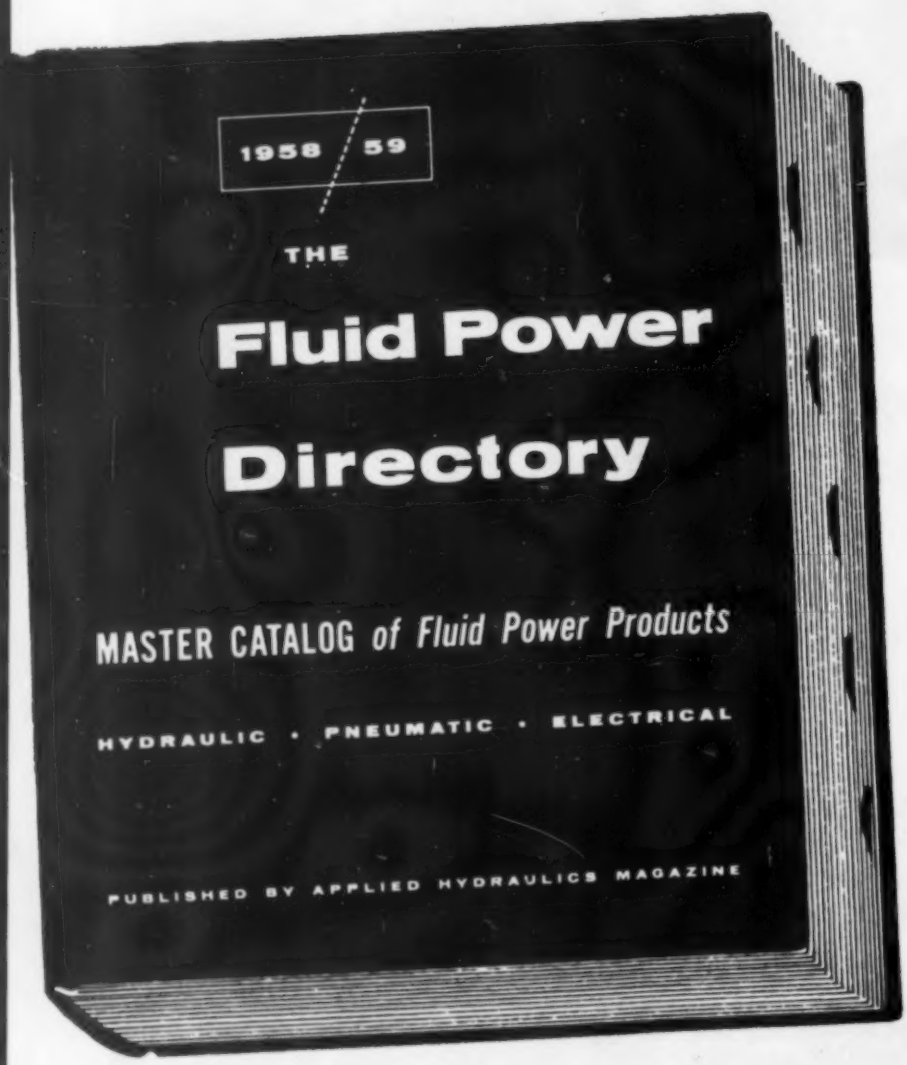
Write for "V"-Ring data sheets.

Circle 91 on Reader Service Card

NOW IN PREPARATION!

The Complete Guide to . . . .

2nd EDITION . . . FLUID POWER DIRECTORY . . . .



SECTION A

MANUFACTURERS' CATALOGS AND SALES OUTLETS—Manufacturers' advertising is arranged in alphabetical order. An index to these specification ads lists manufacturer's name and address of main plant; names and location of U.S. and Canadian representatives.

SECTION B

FLUID POWER COMPONENTS DIRECTORY—Over 140 pneumatic, hydraulic and electrical products for fluid power systems—from accumulators to wiper rings—are listed in this directory. Listings of advertisers appear in bold face along with the note "See Catalog Section A, pages —— to ——".

SECTION C

TRADE NAMES—Alphabetical listing of product trade names gives manufacturers' names and addresses. Bold asterisk points out all advertisers in the Directory.

SECTION D

WHERE TO BUY LOCALLY—The "Yellow Pages" supply information about local fluid component suppliers. Listing is alphabetical by state, city and company name. Advertisers in this section are independent sales companies.

SECTION E

FLUID POWER DESIGN—200 pages of engineering reference material is divided into: JIC and SAE Standards, Nomographs, Design Data, Air and Oil Circuits, Product Information, and Applications and Developments.

. . . FLUID POWER APPLICATION!

. . . . MASTER CATALOG OF FLUID POWER PRODUCTS

The only complete Hydraulic and Pneumatic Reference

YOUR HANDBOOK FOR FLUID POWER—This biennial volume—the 1958/59 edition—will be available in October. Since June 1955, the editors of APPLIED HYDRAULICS have been gathering and editing hydraulic and pneumatic information for this book. You will use the new edition of the FLUID POWER DIRECTORY as a time saver for all kinds of information about hydraulics and pneumatics.

The Components Directory Section lists more than 550 companies who manufacture products in the 140 indexed classifications from accumulators to wiper rings.

In this permanently bound volume, more than 150 manufacturers of fluid power components put their specification-type advertising in your hands—many will include condensed catalog information. Your 1958/59 Directory warrants being called the "bible" of fluid power application and engineering.

UP-TO-DATE INFORMATION—When you're looking for sources of components, or trying to locate the manufacturer of a part for which you have the trade name, or want to quickly locate the local source, or need spec data immediately, it's all in this book. And you have a big PLUS section which is only available in this volume—over 200 pages of Fluid Power Design information. It includes JIC and ASA Standards, nomographs, charts, formulae, a product encylopedia, over 150 circuits, plus applications and developments.

PUBLICATION DATE—OCTOBER 1957

16,000 1958/59 Directories will be put in the hands of men who select fluid power components. A recent survey made to users of the first edition published two years ago shows that each copy is used by more than 5 men. The book is designed for the hard use it gets. It helps every user save time in designing and building fluid powered equipment. Your copy will be your fluid power handbook.

NOTE TO ADVERTISERS—When your sales campaign has done its job, when your advertising campaign is getting you the recognition and the interest you've sought . . . don't break the connection! Make it easy for the buyers to find you when they want you.

File your condensed catalog information in the FLUID POWER DIRECTORY . . . it completes the sales connections!

You can reserve a copy now . . .

$6.50 PER COPY

CLOSING DATE FOR ADVERTISING
JULY 24, 1957

FLUID POWER DIRECTORY
812 Huron Road, Cleveland 15, Ohio

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APPLIED HYDRAULICS

The Magazine of Fluid Power

812 HURON ROAD
CLEVELAND 15, OHIO

BRIEFS about fluid power

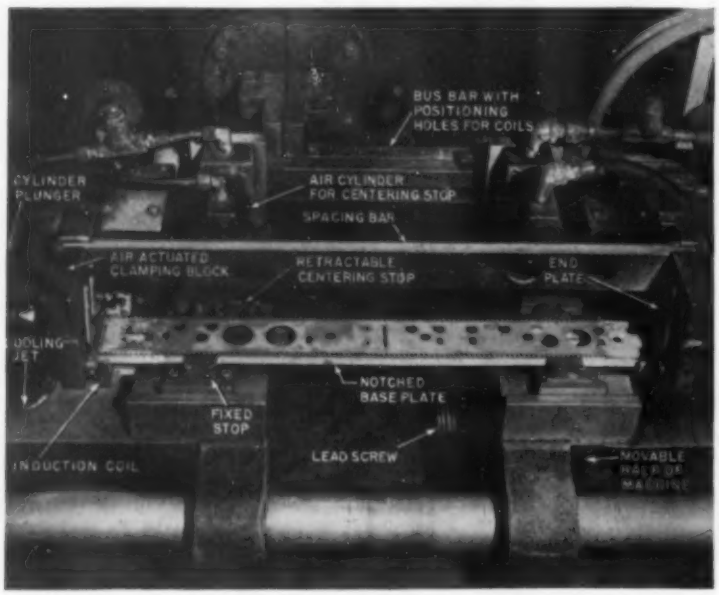
AIR CLAMPING ASSURES PRECISE ALIGNMENT

To achieve correct alignment of typewriter frame end pieces, and prevent any wobbling during the brazing cycle, International Business Machines devised a clamping arrangement operated by two pairs of synchronized air cylinders. Using air clamping, production rate for the carriage frame is slightly more than 2 minutes per frame.

● **Application**—Endwise holding action is produced by a pair of opposed air-actuated clamping blocks which press the end pieces firmly against the base. The transverse holding action, necessary to keep the base at right angles to the end pieces, is produced by a second set of air cylinders which press the base plate against a pair of fixed stops. The air cylinders operate on 80 psi line pressure.

To prevent the two end pieces from tipping inward when the clamping pressure is applied, a spacing bar is laid between them. When the assembly is completed, the operator places the spacing bar in position between the end pieces, trips the air valve which actuates simultaneous clamping action by the end blocks and centering stops, and initiates the brazing cycle.

During the brazing, as the silver alloy melts, the follow-up pressure from the end clamping blocks moves the end pieces slightly inward to take up the space left by the melted shims. The pressure also squeezes out the molten flux and minimizes flux inclusions to produce a stronger joint. Since the base plate is heated locally, it undergoes little expansion during the brazing cycle. Whatever expansion does occur is absorbed by the slight compressibility in the air fixtures, so that there is no problem of warpage from clamping both ends of the base. ▼▼▼



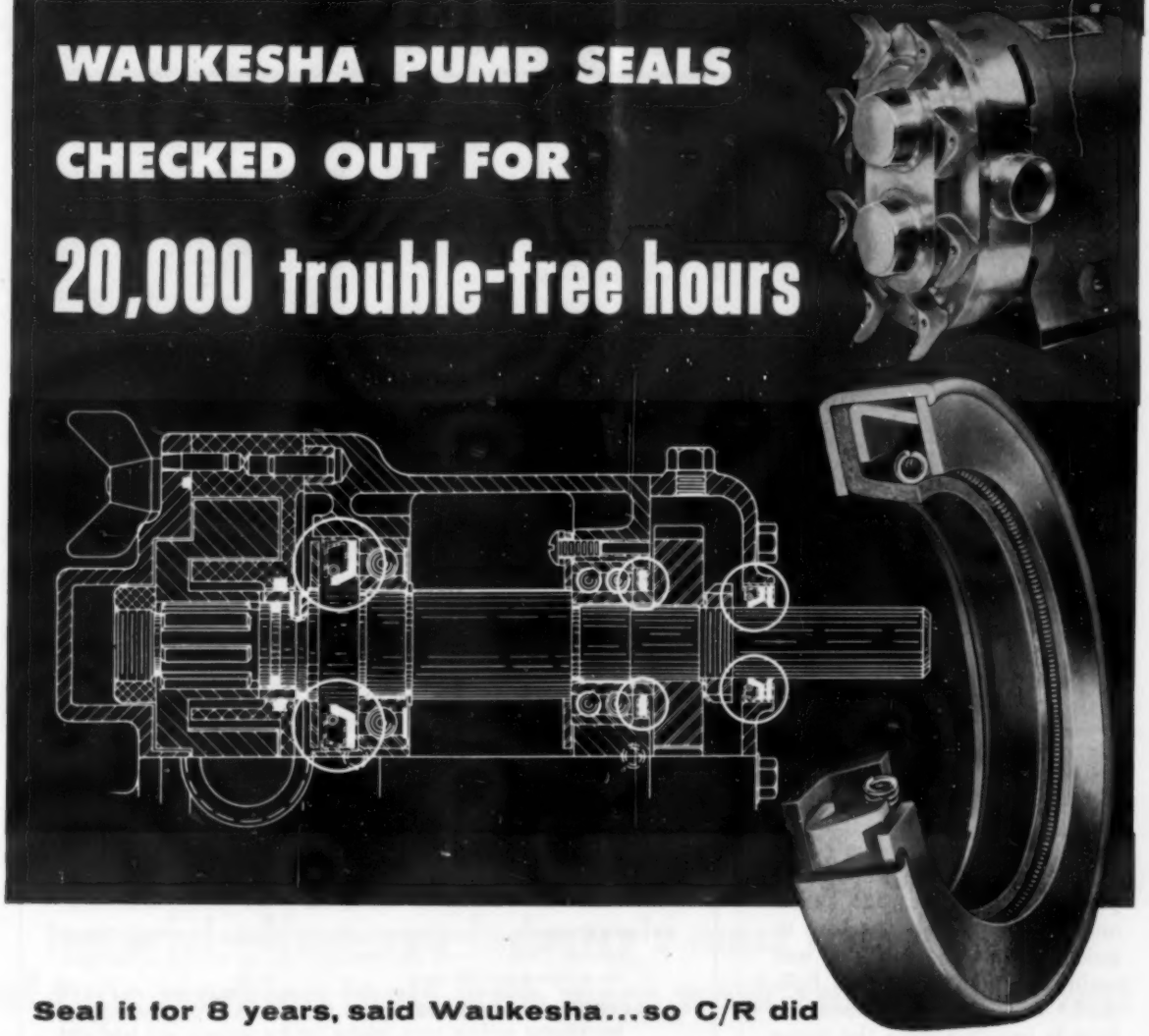
Hydraulics Gives Car Six-Directional Motion

In designing a system for automatic batch impregnating of racks of transformers, engineers at General Electric's Fort Wayne plant and Blaw-Knox Company, Pittsburgh, used hydraulics for flexibility and fine control. Key to the operation is a remotely controlled, driverless car with a traversing carriage to load, discharge and transfer racks of transformers through several stages.

● **Car and Carriage**—Required motions are made possible through a car and carriage arrangement. The carriage bed is lifted and lowered through a set of four hydraulically operated screw jacks. The car travels at one-half foot per second. It is 12 feet wide and 10 feet 8 inches long, weighs 20,000 pounds and will carry 12,000 pounds. The carriage is 12 feet long, 4 feet 2 inches wide, and traverses at right angles with the

Continued on page 26

WAUKESHA PUMP SEALS CHECKED OUT FOR 20,000 trouble-free hours



Seal it for 8 years, said Waukesha...so C/R did

"And, we might add, we have had very, very few instances of failure with C/R Oil Seals," says Mr. Emil M. Howe, Vice President, Pump Division of the Waukesha Foundry Co. Long service life is only one of the requirements met by the C/R Types P, G and A Oil Seals in this Waukesha Sanitary Pump. They must seal effectively eight hours a day, six days a week for eight years . . . at shaft speeds up to 750 r.p.m., with pump head pressures up to 150 p.s.i., and temperatures ranging from 0° to 220° F., depending on the food material pumped. They also must resist food acids, and the acids and alkalies in the commercial detergents used to cleanse and flush the pump daily. An added indication of C/R Oil Seal dependability in the Waukesha Sanitary Pump is the fact that it constantly must meet rigid 3-A Sanitary Standards for the Dairy and Food Industries.

If you have a sealing problem . . . equally critical . . . or simple . . . bring it to Chicago Rawhide. C/R engineers will help you select the correct oil seal for your application from stock . . . or cooperate with you on special designs.

More automobiles, farm and industrial machines rely on C/R Oil Seals than on any similar sealing device.

OIL SEAL C/R DIVISION

CHICAGO RAWHIDE

CHICAGO RAWHIDE MANUFACTURING COMPANY
1203 Elston Avenue Chicago 22, Illinois

Offices in 55 principal cities. See your telephone book.

In Canada: Manufactured and Distributed by Chicago Rawhide Mfg. Co. of Canada, Ltd., Hamilton, Ontario

Export Sales: Geon International Corp., Great Neck, New York.

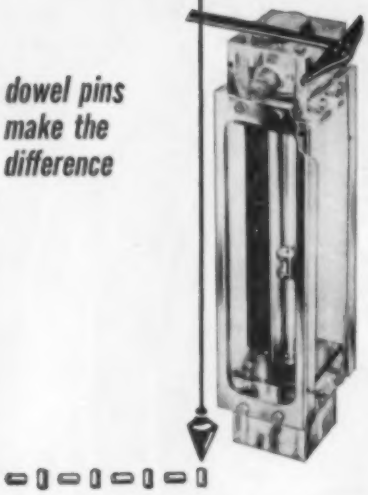
Other C/R Products
Sirvene (synthetic rubber) molded pliable parts • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic Gears

BROOKS LEADERSHIP
achieved by design

FULL-VIEW* ROTAMETER

NO TORQUE
NO LINE
STRAIN

dowel pins make the difference



8 stainless steel dowel-pins precisely align the side plates and end fittings, are the keys to quick, trouble-free assembly and maintenance of the Brooks Full-View* Rotameter. The metering tube is installed *after* the frame is completely assembled. Tube breakage due to line strain and misalignment is thereby eliminated. It's as simple as placing a round peg in a round hole.

This feature, if considered alone, would make dowel-pin, side-plate construction your most important rotameter specification.

Send for Bulletin 115

*Trade-Name

BROOKS ROTAMETER COMPANY
657 L STREET
Lansdale, Pennsylvania

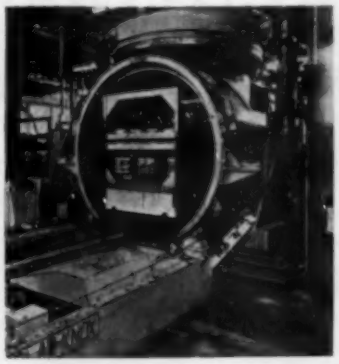
A complete line...
BROOKS ROTAMETERS
...for every service

BRIEFS continued

motion of the car. Limitation controls on the car and carriage align it in all positions to within one-eighth of an inch.

• **Hydraulics**—All car and carriage motions are controlled by three hydraulic motors, powered by a 5 hp electric motor connected to the hydraulic pump. One hydraulic motor controls forward and reverse car movement; a second controls the lifting action; and a third controls the traversing action of the carriage. Hydraulic motors were specified because they occupy much less space for the horsepower required. The hydraulic system contains 30 gallons of oil.

• **Circuit**—Arrangement of the double solenoid valves provides



for individual operation of the hydraulic motors. While the motor powering the table lift is operating, the car and carriage motors operate as pumps. Relief valves

Continued on page 28

BRIEF NOTES

"OVERWORKED AND UNDERPOWERED" . . . a new educational film available from the Educational Committee of the Compressed Air and Gas Institute, Terminal Tower, Cleveland, Ohio, points out common difficulties in air systems and gives corrective measures.

VALVE RATINGS . . . After burst testing all types at 12,000 psi without failures, Fluid Controls, Inc., Mentor, Ohio, has decided to rate their check valves at 5,000 psi.

V-PACKINGS STANDARDIZED . . . E. F. Houghton & Co., Philadelphia, has adopted uniform stack heights for homogeneous and fabricated rubber and leather types. All three materials will fit in the same types. All three materials will fit in the same gland space and will be completely interchangeable.

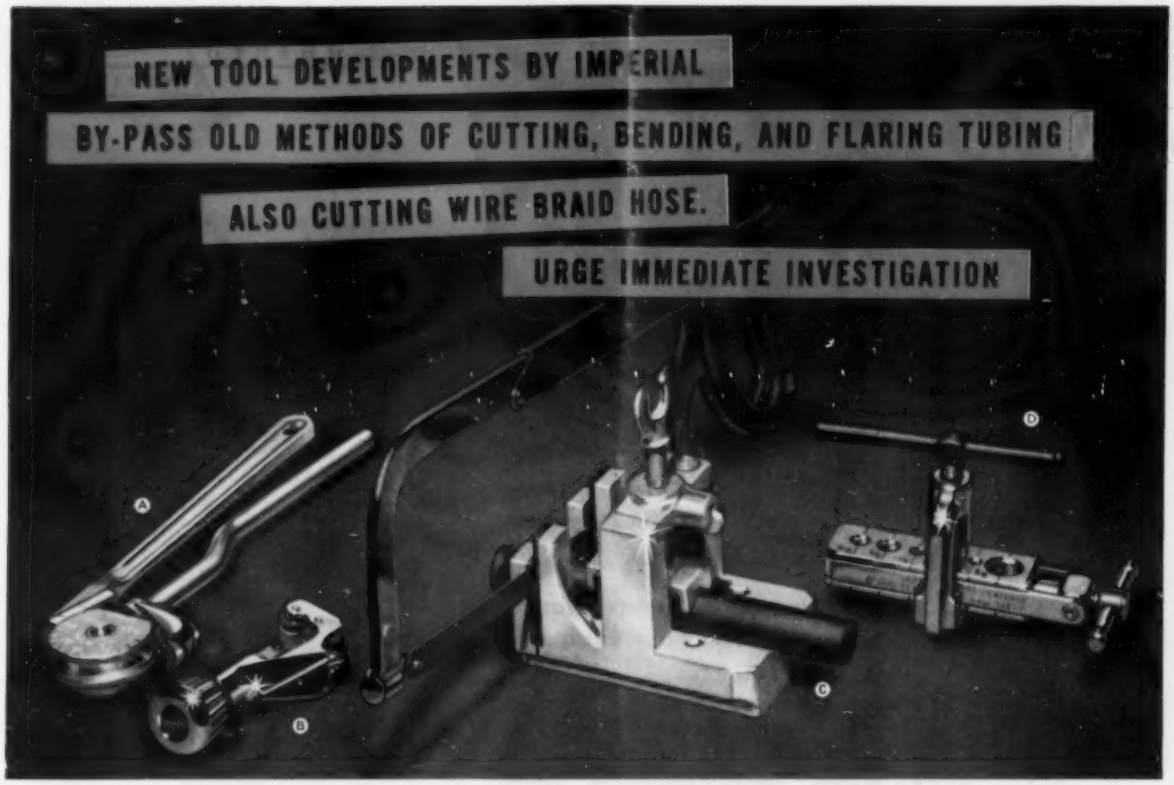
BUSINESS BRIEFS

SALES IN 1957 TO EQUAL 1956 . . . for Standard Pressed Steel Co., according to Thomas Hallowell, Jr., president. Net sales of $51,600,000 in 1956 represented a 25% increase, for the second consecutive year, over the preceding year.

GUIDED MISSILE WORK . . . has increased the sales backlog at Northrop Aircraft, Inc., Hawthorne, Calif. Whitley C. Collins, president, reported the sales backlog was $316 million as of January 31st, up about $32 million from the previous quarter.

PEAK SALES IN 1956 . . . were reported by Hansen Manufacturing Co., Cleveland. Sales and earnings were $2.8 million compared with $2.7 million for 1955. Sales this year are running well ahead of the same period a year ago.

CONTINUED PROGRESS . . . for Robertshaw-Fulton Controls Co., Greensburg, Pa., was forecast by John A. Robertshaw, president, who stated expansion, increased foreign manufacturing operations, and new products had created new markets.



Ⓐ **Bends hard or soft tubing.** Open side design. Forms neat, accurate bends, any angle up to 180°. Calibrated. Specify No. 364-FH "Blue Dot" bender. Sizes: ⅛ to ¾" O.D. tubing. Individual benders for each size.

Ⓑ **Spare cutting wheel now included at no extra cost!** Exclusive! Fits behind retractable reamer. Instantly available for emergencies. Cutter has free-wheeling, ball bearing action. No. 274-F Hi-Duty tube cutter for ⅛ to 1" O.D. tubing.

Ⓒ **Saws wire-braid pressure hose with minimum wear to hacksaw blade.** Square, clean cuts due to special hose gripper. Extra-tight, slide-to-size clamping. For ⅜ to 1½" O.D. hose or tubing. Bolts to bench or clamps in a vise. No. 384-F illustrated.

Ⓓ **Now with industrial hard chrome cones.** No extra cost! Smoother flares, up to 55% easier! Types for 45°, 37° and double flares. No. 437-F for 37° flares on soft steel tubing to J.I.C. standards. Sizes: 3/16, ¼, 5/16, ⅜, ½ and ⅝" O.D. tubing.

Imperial offers you industry's most complete line of tube working tools with more work-saving features!

If it's new . . . it's from Imperial! The complete tubing tool line with more "firsts" to its credit continues to take the "work" out of tube working with *more* new developments!

That means no matter what the tubing . . . copper, aluminum, steel or stainless steel . . . or the type of job, you're adding greater accuracy, speed, ease and better craftsmanship to cut costs right down the line. *Tool up with Imperial and be first with the latest!*

Avoid lost time and grief by replacing labor-wasting tools NOW with years-ahead IMPERIAL tubing tools. See your Imperial distributor now, or write for Catalog 3011.

No. 500-F and No. 507-F Rol-Air flaring tools for 45° and 37° flares.

No. 140-F Test plug — for closing end of tube temporarily. Pressures to 100 lbs.

No. 206-F — Adjust-o-matic, slide-to-size tube cutter. For ¾" to 2¼" O.D. Tubing.

No. 400-F flares stainless, steel, titanium — other metal tubing to AN standards.

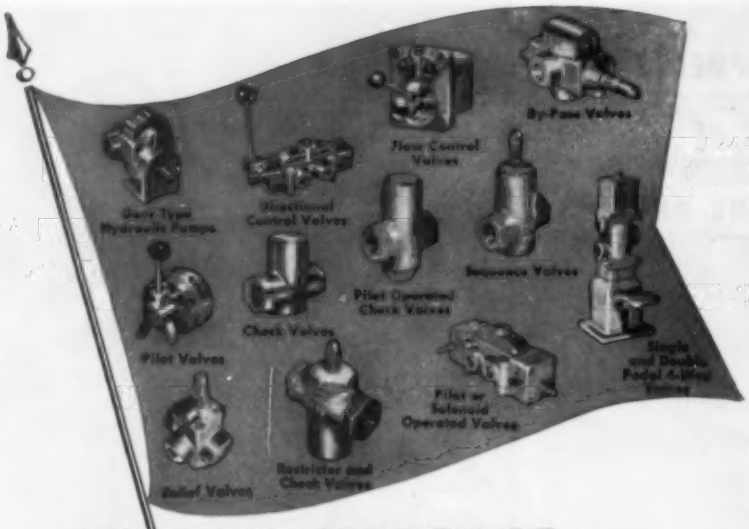
No. 270-F Gear type bender bends any type of tubing.

No. 260-F tube bender combination for 7 sizes: ¼ to ⅞" O.D.

IMPERIAL

THE IMPERIAL BRASS MFG. CO.
1242 W. Harrison St., Chicago 7, Ill.
In Canada: 334 Lauder Ave., Toronto, Ontario

Emblem of Quality



BY ANY STANDARD...

ADEL *Refinements* assure Plus Performance for Your Equipment

Designers and Engineers have set these standards for Industrial Hydraulic Equipment

Rugged simplicity • Long life • Simplification of piping • Reduced installation costs • Greater accessibility for maintenance • Completeness of line • Over-all economy

ADEL brings them all to you!

Smooth economical hydraulic power for Pushing, Pulling, Lifting, Pressing, Clamping and Controlling.

Illustrated are but a few of a wide variety of ADEL industrial hydraulic control equipment that offer definite benefits to both the user and builder of machine tools and many other kinds of equipment. ADEL products incorporate proven design and precision construction features that assure dependable operating efficiency over the years. A complete line for every application. You can simplify your Hydraulic Power Motion Problems by specifying ADEL.

For complete engineering specifications and counsel, Address: ADEL PRECISION PRODUCTS, 10771 Van Owen Street, Burbank, California

Reliability

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A DIVISION OF GENERAL METALS CORPORATION

BURBANK, CALIFORNIA • HUNTINGTON, WEST VIRGINIA

Manufacturers of MARINE & INDUSTRIAL HYDRAULIC CONTROL EQUIPMENT

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TEXAS •
Air-Draulic Equipment Company
Houston, Texas

UTAH •
Robert Taylor & Sons
Salt Lake City 10, Utah

WASHINGTON •
Haskel Engineering & Supply Co.
Seattle, Washington

BRIEFS / continued

decelerate the car and carriage. Check valves in the table and carriage motor circuits direct motor leakage to a return line, eliminating extra drain hosing. Carriage is locked by positioning cylinders acting against balls in V-slots in the carriage frame. ▼▼▼

The Drivmatic, an automatic, electro-hydraulic drilling and riveting machine, was developed by Martin to produce fuel-tight aircraft wings without the usual liner or secondary fuel container. The machine clamps the work piece in place, drills and countersinks the hole, drives the rivet and positions itself for the next sequence. The entire operation is controlled by a perforated tape which actuates electromechanical and hydraulic devices to complete the operation.

Finger Tip Hydraulic Control Speeds Ice Loading

At Blue Island, Ill., Link-Belt Company's automatic dock-type car icers accelerate the re-icing of about 1,400 refrigerator cars every day. The Model 55 icer, track-mounted and self-propelled, consists of a pick-up conveyor, a crushing unit, a reversible cross conveyor and two pivoted discharge chutes which deliver to the bunkers. It is operated by one man who has complete control of the entire operation of machine and conveyors.

• **Electro-Hydraulic Controls** —Through a system of hydraulic and electronic controls, the operator has complete control over the icer and the dock conveyor which

Continued on page 30

WM. W. NUGENT
Founder

CORLISS D. NUGENT
President

WM. WARREN NUGENT
Secretary

Before we cut the cake...

Wm. W. Nugent & Co., Inc., on the occasion of its sixtieth anniversary, wishes to express its sincere appreciation for the confidence and loyalty toward Nugent products, demonstrated by an ever increasing acceptance throughout industry.

For three generations, Nugent products have embodied only highest quality design, materials and workmanship. The future shall find no compromise with that policy.

Established 1897

Wm. W. Nugent & Co., Inc.

3432 Cleveland Street Skokie, Illinois

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Representatives in Boston • Cincinnati • Detroit • Houston • Los Angeles • Minneapolis • New Orleans • New York • Philadelphia • Portland, Oregon • San Francisco • Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

now . . . AIR VALVES

WITH EXTREMELY FAST RESPONSE

Pat. Pending

. . . Almost TWICE As Fast As Ordinary Valves!

The new SA Series single solenoid actuated valves are available in both single and dual pressure models with extremely fast response time. You get total response in 12 *milliseconds*—from energizing to wide open on 60 cycle current. That's almost *twice as fast* as any pilot operated solenoid control valve available today!

All SA Series valves are high performance, full pipe area valves . . . furnished for service on vacuum and air at pressures from atmospheric to 250 psi . . . and at speeds from the most intermittent job in your plant to welding guns. Optional metering valves give simple, sensitive control of piston speed by metering the exhaust air. Exhaust noise is muffled.

The design simplicity of the SA Series valves provides extremely long life and requires a real minimum of maintenance. Only one moving part provides the valving action . . . a corrosion-resistant steel spool and sleeve.

Complete information on the SA Series valves . . . the greatest advance in air controls . . . can be obtained by writing today for your copy of Catalog 8000.

NUMATICS, Inc.

MILFORD, MICHIGAN • DEPT. AH

BRIEFS / continued

feeds ice to the machine. From his station, he controls travel of the machine in either direction and operates the hydraulic track

brakes which permit fast, sure positioning. He also controls the size of ice, directs it to either side of the dock, raises or lowers the discharge chutes to adjust for car height, and operates the flop gates which direct the ice flow into the proper hatch. ▼▼▼

This tractor mounted front end loader uses a portion of its tubular frame for a hydraulic oil reservoir. Another interesting feature is that the hydraulic piping is enclosed in the loader arms for protection. Superior Equipment Division, Wheeling, Ill., designed the loader for mounting on low silhouette, four wheel industrial tractors.

Electro-Pneumatic Machine Speeds Production

Five screws are driven into a transmission stator without indexing or fixtures on an automatic torque control multiple screw driver designed by D and L Tool and Machine Co., Detroit, Michigan. The machine automatically feeds

Continued on page 32

Circle 86 on Reader Service Card

Circle 14 ⟶

This B&W Welded Mechanical Tubing Was Ready for Use on Delivery

Guaranteed Maximum Average Micro-inch Finish on the I. D. to Meet Hydraulic System Needs

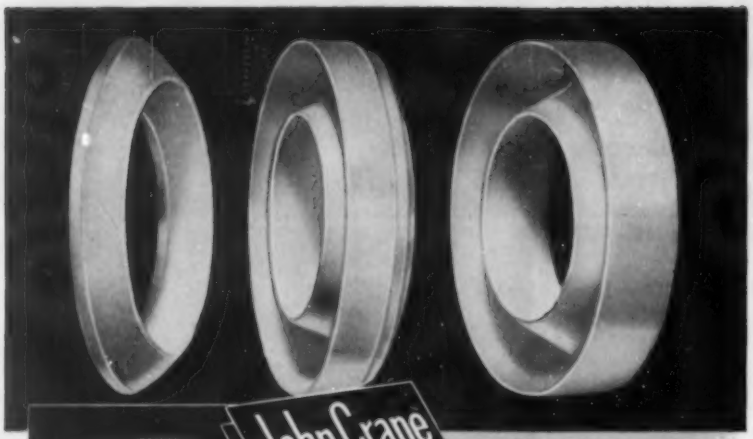
B&W ERW Mechanical Tubing, with smooth I.D., can be delivered to you ready to use in hydraulic systems. Where inside surface is of prime importance and no stock removal is planned prior to application, this tubing is made for the job because it is furnished with a smooth inside surface having a guaranteed maximum average micro-inch finish.

In addition to smooth inside finish, this B&W Tubing assures you of uniform wall thicknesses, plus uniform and close I.D. tolerances. It combines light weight and high strength. It means long life and better performance in fluid systems for heavy duty or automation applications.

For complete information on B&W ERW Mechanical Tubing with smooth I.D., or on any tubing problem, call for Mr. Tubes—your direct link with B&W. Write for Bulletin TB-419. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

TA-6102 M3

Seamless and welded tubular products, seamless welded fittings and forged steel flanges—in carbon, alloy and stainless steel.



John Crane

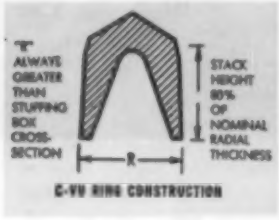
CHEMLON *

C-V RINGS

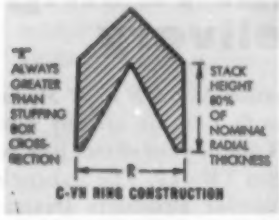
ARE INDUSTRY'S MOST UNIVERSAL PACKING . . .

Countless successful applications of C-V Rings under the most severe service conditions have made this the closest approach to a universal packing.

It will effectively handle all industrial acids, alkalis, solvents, organic and hydraulic fluids . . . temperatures from —120°F. to +500°F. . . . is equally suited to valves, pumps, mixers, hydraulic cylinders and like equipment.



C-VU RING CONSTRUCTION



C-VH RING CONSTRUCTION

"John Crane" C-V Rings have extremely low coefficient of friction. "Breakout" friction is only slightly higher than running friction.

TWO STYLES ARE AVAILABLE:

C-VU RINGS *for low pressure service* —such as control and regulator valves handling gases and fluids, where it is necessary to have a very sensitive and resilient type packing.

C-VH RINGS *for high pressure service* —for use in pumps, hydraulic cylinders and like services at pressures ranging to 500 psi. and over. These rings are constructed with a heavy wall heel to withstand pressure requirements. They are designed to provide voids between rings, so that as the Teflon expands due to heat, this take-up room minimizes any excess friction in the stuffing box.

"John Crane" C-V Rings are available in full line of standard sizes and male and female adaptors. Sizes can be molded to stuffing box specifications.

Request Bulletin P-325

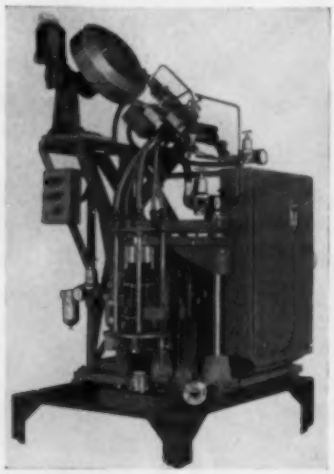
*"John Crane" C-V Rings are made from Chemlon—*the best in DuPont Teflon.*

Crane Packing Co., 6405 Oakton St., Morton Grove, Ill. (Chicago Suburb). *In Canada: Crane Packing Co., Ltd., Hamilton, Ont.*

CRANE PACKING COMPANY

BRIEFS continued

and drives the five screws simultaneously. The screws are gravity fed to their position on the transmission stator just before the air motors engage the five air drivers on the travelling head. The drivers provide accurate torque control and use clutch action instead of air motor stall to obtain the



required torque. Air pressure loading of the spindle holds the drive bit against the screw head throughout the one inch travel.

• **Controls**—A sensitive air-electric system, synchronized with the travelling head, controls the feeding. The machine control system includes a filter, lubricator and regulator, an indicator in the inlet line, and individual regulators for the air motors, main air cylinder and screw escapement mechanism. Each cycle must be properly completed before the next one can start. ▼▼▼

Stainless Steel O-Rings

• **Withstand extreme temperatures**—Development of O-rings that will withstand temperatures to 500 degrees was undertaken by Republic Aviation Corp., Farmingdale, N. Y. Stainless steel was chosen because of its fatigue strength and corrosion resistance at high temperatures. The three types of O-rings tested at the high temperature laboratory were: plain rings simply welded togeth-

Continued on page 36

. . . Fluid Power news

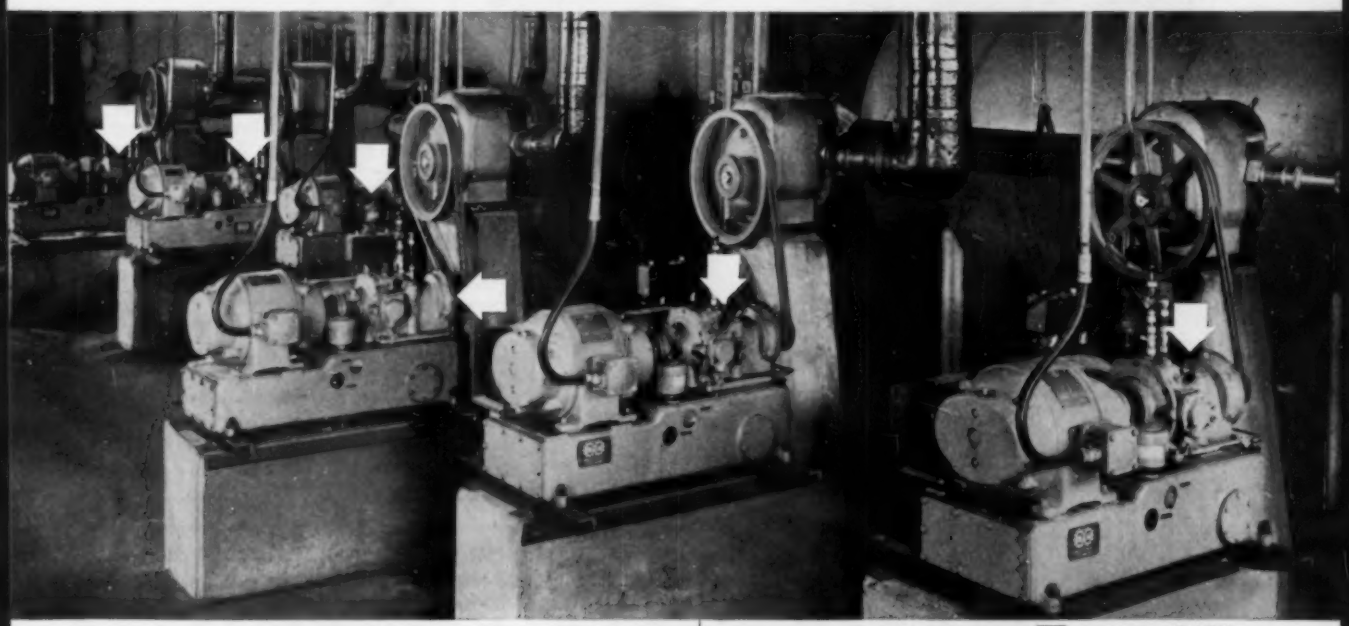
REPORT NO. 11,300 NEW LIQUID LEVEL CONTROL

From Oilgear Application-Engineering Files

HOW OILGEAR DRIVE AND CONTROL SYSTEM STABILIZED BEER FILLING LEVEL

CUSTOMER: *Large Western Brewery (Name witheld by request)*

DATA: Highly carbonated beverages must be handled gently. Throttling flow of beer into filling machine reservoirs causes foam and irregularity of liquid height, making accurate filling of cans or bottles difficult. These reservoirs are small compared to the flow through them. Costly losses are incurred on tax-paid cans "in process" due to under or overfilling. Any beer pump drive-control system must respond immediately, have smooth action, and be unaffected by daily wash-downs required to maintain sanitary operations. Accurate automatic control, dependable operation, and ease of maintenance—as always—are important factors in the selection of this equipment.



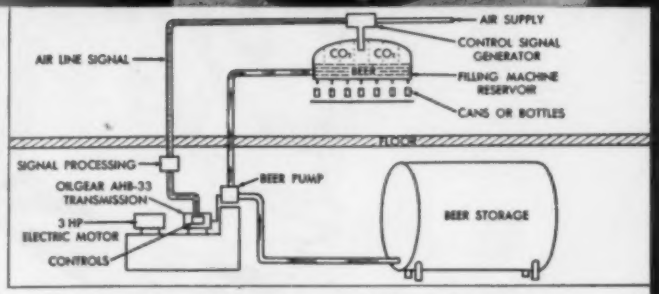
SOLUTION: Shown "on the job" above, are 6 Oilgear AHB-33, two-way, "Any-Speed" transmissions driven by 3 hp electric motors, mounted on standard reservoir bases. Transmissions drive beer pumps through dual "V" belts. Beer is pumped from storage tanks to bottle or can filling machine reservoirs on the floor above. Liquid level in filling reservoirs is controlled automatically by a low pressure CO_2 signal . . . as level rises, pressure rises . . . as level falls, pressure falls. Translated to air pressure signals, which, transmitted to controls on Oilgear transmissions, automatically-instantly increase, decrease, reverse, or stop the beer pumps. Where former throttling system caused foam and irregular levels, this Oilgear system holds reservoir level to $\pm 1/16''$ under continuous operation . . . assuring accurate filling of each can or bottle. Beer pumps are flushed under water pressure without disconnecting drives. Several years of continuous service have proven drives to be extremely dependable under all conditions, with little or no attention.

Oilgear Application-Engineering can also provide practical solutions to your linear or rotary drive problems. Call the factory-trained Oilgear application-engineer in your vicinity. Or write, stating your specific requirements, directly to . . .

THE OILGEAR COMPANY

Application-Engineered Fluid Power Systems

1564 WEST PIERCE STREET • MILWAUKEE 4, WISCONSIN

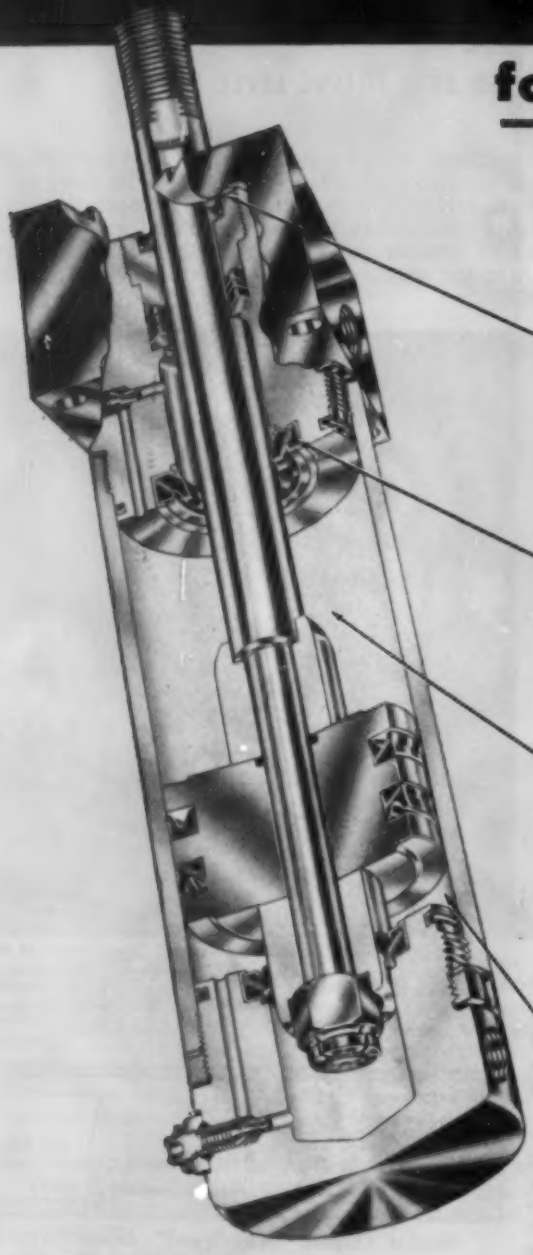


Similar Oilgear "Any-Speed" drives have improved performance on can closing, filling; paper, printing, textile, tape, and rubber processing machines; extruders, capstans, winders, stokers, centrifuges, gang-saw feeds, saw mill carriages, conveyors, and the like. They provide efficient conversion of any constant rotary motion to accurately controlled variable rotary motion . . . smooth, stepless, uniform acceleration from zero to maximum in either direction . . . manual, hydraulic, electric or electro-hydraulic controls—providing complete flexibility of location . . . low power consumption—using power only in proportion to work performed . . . durable, trouble-free, low maintenance due to simplicity and automatic lubrication of all rotating parts.

Need a cylinder today?

for all these Extras . . .

T-J Spacemaker



PISTON ROD SCRAPER . . . Not just a felt or fabric wiper, but a metal to metal contact. Protects rod packing and cylinder bores at all times by actually removing foreign particles from piston rod surface. STANDARD AT NO EXTRA COST!

NEW "SUPER" CUSHION FOR AIR . . . Of T-J design and patent, it assures millions of trouble-free cycles. Years of T-J research and test have answered the problem of "how to make a cushion last". All T-J cushions are adjustable, STANDARD AT NO EXTRA COST!

CHROME PLATED CYLINDER BORES AND PISTON RODS . . . The piston rod, of course. But of these two features, the chrome plated bore is by far the most important, due to the much greater area that is subject to wear. Chrome plating of bore gives extra protection where needed most. Also a protection from condensation and foreign matter, that may find itself into the system. STANDARD AT NO EXTRA COST!

ONE PIECE PISTON . . . Giving you three point surface bearing which increases the distance from the piston end to the rod bearing. This T-J feature assures better alignment, longer bearing and packing life. STANDARD AT NO EXTRA COST!

off shelf delivery

. . . Just call T-J

at no Extra Cost!

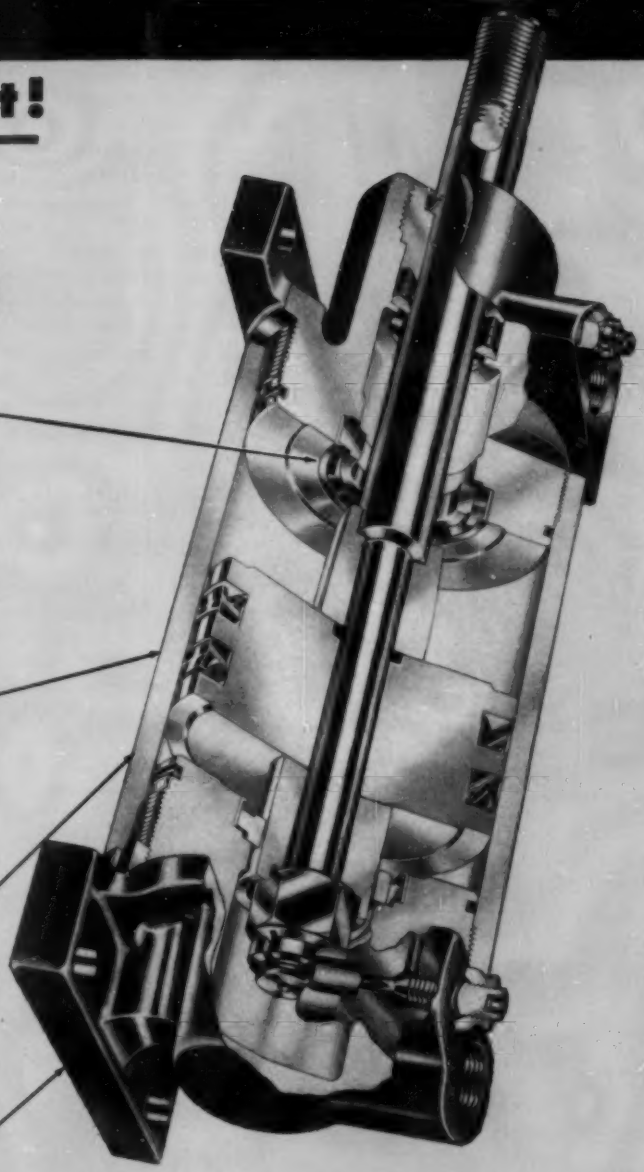
cylinders

NEW "SELF-ALIGNING" MASTER CUSHION FOR HYDRAULIC USE . . . (Pat. Applied For) New T-J cushion design eliminates problems of worn out, or out-of-line cushion seals. Eliminates need of a ball check while greatly increasing the return flow, assuring fast breakaway on return stroke. All T-J cushions are adjustable, STANDARD AT NO EXTRA COST!

NO TIE RODS TO STRETCH . . . By eliminating tie rods, the T-J SPACEMAKER gives you 360 degree port rotation, streamlined design, no tie rod stretch, without sacrificing strength. STANDARD AT NO EXTRA COST!

STREAMLINED DESIGN . . . Minimum center-line to center-line mounting—years ahead and in keeping with modern trends. Easy to clean for an extra appearance on your machine, without sacrificing strength. Oil pressure to 750 P. S. I.—air to 200 P. S. I. STANDARD AT NO EXTRA COST!

FORGED SOLID STEEL HEADS . . . (4" bore through 8" bore) Requires no additional mounting brackets, because mounting holes are a part of the one piece solid forged steel head. Its design lends itself to smooth streamlined modern appearance. STANDARD AT NO EXTRA COST!



WRITE TODAY for new bulletin with complete details of the T-J Spacemaker line, or call Jackson, Michigan, State 2-0462.

MEMBER OF THE NATIONAL FLUID POWER ASSOCIATION

THE TOMKINS-JOHNSON CO.

JACKSON, MICHIGAN

RIVITORS . . . AIR AND HYDRAULIC CYLINDERS . . . REAMERS . . . CUTTERS . . . CLINCHORS

Circle 127 on Reader Service Card

only the

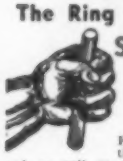
Fall Gets it All!

WHY be satisfied with only partial removal of dirt or other foreign accumulation from piston rods when you can—

Remove ALL the Dirt from Rod O.D. Stop Dirt Passing Through the Ring Joint

with a Fall "CJ" WIPER RING

The Ring with a Closed Joint



SPRING LOADED with Squeeze Grip Action

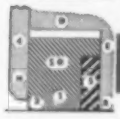
FALL "CJ" Wiper Rings remove the dirt adhering to the piston rod as well as preventing it from passing through the joint. FALL Wiper rings are spring loaded and the—

SPRING LOADED

Endless Spring in O.D. of Ring Maintains Continuous Squeeze Grip Action on the Rod

—preventing ring from ever opening up, assuring automatic "take up" of all wear and stopping build up under ring. The closed joint feature means piston rod is kept CLEAN on its ENTIRE O. D. . . . nothing passes through the joint or under the ring. Moisture, liquids, etc., are sealed out when certain of our rubber seal features are added to ring.

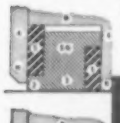
SQUEEZE GRIP ACTION



SEALS OUT

Spotty Contact of Ring on Rod Eliminated

We pre-actuate each ring with our factory DRY-LAP process. This avoids possibility of metal fragments detaching & entering packing gland or bearings AFTER ring is installed. It creates a light tight true circle wiper edge to the ring.



DRY-LAP PROCESS

FALL Rings are popular with industry because they do the job. They are adapted for use in both hydraulic and air installations. Available from ⅛" diameter upwards in either bronze, cast iron or stainless steel. If you have a wiper ring problem write, wire or phone us.

Four types of many Fall "CJ" Wiper Rings are shown above.

All Fall Rings are covered by patents issued or patents pending.

ACE PRODUCTS CO.
Toledo 1, Ohio
Phone Cherry 3-6513

Fall Wiper Ring SPRING LOADED

You Can Depend on ACE Products —Established 1935 !

BRIEFS continued

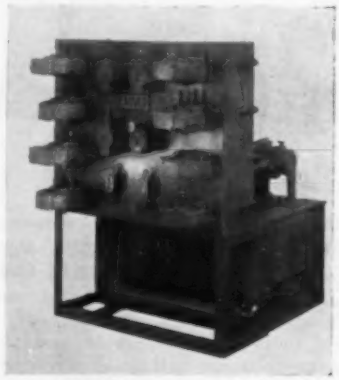
er, pressure compensating rings, and gas filled O-rings.

• **Tests**—were set up to simulate actual flight conditions. The pressure was changed from zero to 300 psi, 40 times per minute at 500 degrees F.

• **Results**—proved the pressure compensating rings superior to the other two types tested. This type lasted over 500,000 cycles. Maximum requirement for landing gear hydraulic lines is 40,000 cycles, while flight control requires several hundred thousand cycles. ▼▼▼

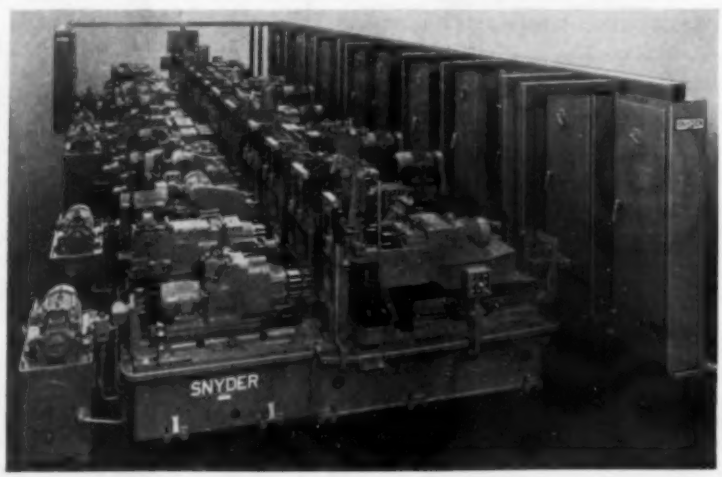
Power Package With Separate Motor Drive

Designed by J. N. Fauver Co., Inc., Detroit, Mich., unit has two single hydraulic pumps, with separate motor drive. An accumulator stores the excess fluid during the idle time so that high speed is available. With this arrangement an equalizing device is required to keep the two cylinders working together, which is accomplished by coupling up two fluid motors. A pressure switch and a small



solenoid valve are provided to bypass the pump when the accumulator is completely charged. A large solenoid valve controls the direction of motion of the cylinder. ▼▼▼

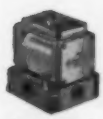
Continued on page 38



This hydraulically operated, 53 station segmented transfer machine processes 80 transmission cases per hour. Built by Snyder Tool and Engineering Co., Detroit, the machine has 13 segments, each separately controlled, permitting independant part clamping, machining and unclamping. Fluid power for the 13 way-type machining units is provided by five separate hydraulic pump and tank units. The machine has a master control panel, which indicates the operating condition of each segment, and an automatic lubrication system.

Off 'n On in less than 2 minutes!

Another Plus Value —in *NOPAK-MATIC* poppet-type Air Control Valves



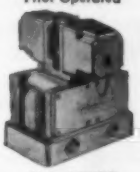
300 SERIES
2-, 3-Way
Master Valves

400 SERIES
4-Way
Master Valves

310 SERIES
2-, 3-Way
Single Solenoid
Pilot Operated

410 SERIES
4-Way
Single Solenoid
Pilot Operated

320 SERIES
2-, 3-Way
Double Solenoid
Pilot Operated



420 SERIES
4-Way
Double Solenoid
Pilot Operated

New Nopak-matic valves provide millions of trouble-free operations. But even should maintenance be necessary, it's faster and easier with Nopak-matic. Here's why . . .

- All models are subplate mounted. To remove a valve from the line takes less than two minutes. Four screws are loosened, the valve removed. Piping is never disturbed.
- Complete in-the-line maintenance can be done in less than fifteen minutes.
- Piston-poppets are contained in easily removable units . . . even seats are quickly replaceable.
- A complete pilot head can be replaced in a few minutes. Any Nopak-matic pilot head (master, single or double solenoid) can be used on any valve.

***NOPAK-MATIC* valves meet *all* J.I.C. Standards**

CATALOG 105 describes in detail all the Nopak-matic Plus Values and gives complete installation and parts data. Send for your catalog now and it will be forwarded promptly!

NOPAK ***VALVES and CYLINDERS***

GALLAND-HENNING NOPAK DIVISION • 2743 South 31st St. • Milwaukee 46, Wis.

A6-602-1P

This new booklet . . .

. . . tells you how CARBIDE's UCON Brand hydrolubes spell safety for you, your plant, and your employees.

Yes, industrial experien e over a period of more than 10 years has shown that the common fire hazards connected with hydraulic operations are eliminated when UCON hydrolubes are used. So, why not find out how the fire-resistance, outstanding anti-wear characteristics, and corrosion protection of new and improved UCON hydrolube "CP"-type fluids can help spell safety for you. Write for "Ucon Hydrolubes Spell Safety," Form 40134.

CARBIDE AND CARBON CHEMICALS COMPANY

A Division of Union Carbide and Carbon Corporation

30 East 42nd Street New York 17, New York

"Union" is a registered trade-mark of Union Carbide.

BRIEFS continued

Spreading The Gospel . . .

. . . *at home*

The Weatherhead Company's Fort Wayne Division has started a technical training school for their industrial distributors. The week's program is under the supervision of Gene P. Robers, general sales manager of the distributor division.

In addition to educational lectures, the students make various brass fittings, pipe and hose assemblies. The class also conducts tests in the Fort Wayne Division testing laboratories. A tour of two Weatherhead plants is included in the schedule of activities.

. . . *on the road*

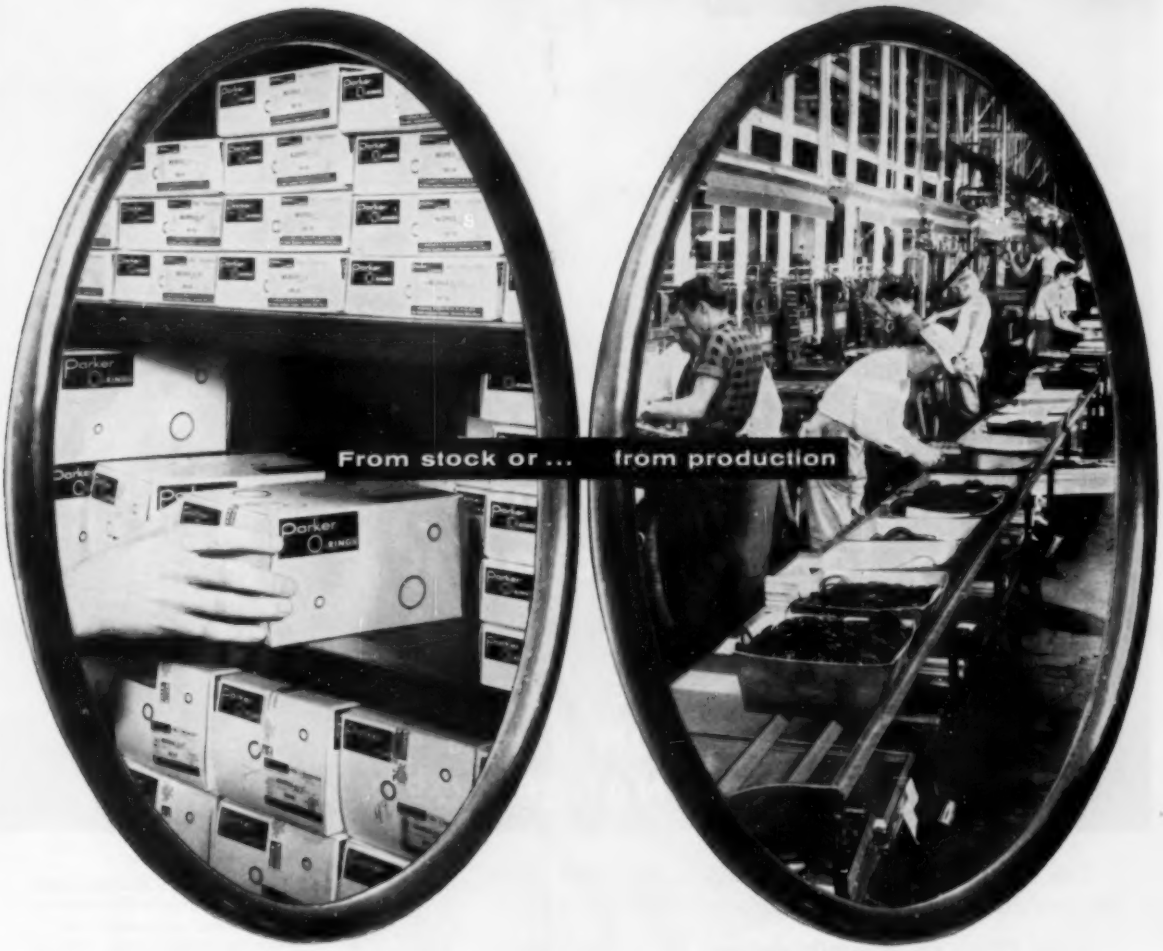
Four roving "colleges" are now touring the country giving production and maintenance engineers and students a chance to

learn about cylinders and fluid power. Each of these colleges, sponsored by Miller Fluid Power, is a fully equipped classroom in a modern, air-conditioned bus. A revolving panel with working cylinders, boosters and accumulators allows the instructor to demonstrate typical installations and applications during the lecture. The course includes an explanation of air and hydraulic cylinders, treats leakage problems, design features, air hydraulic boosters, basic circuits, accumulators and pumps. Graduates of these colleges receive an inscribed diploma which signifies completion of the course.

▼▼▼

Continued on page 42

No matter how many you need...



we offer fast delivery of O-rings!

Parker can meet *any* demand for O-rings. Factory stocks (millions of O-rings) are maintained in Chicago, Cleveland and Los Angeles. Large warehouse stocks are available at more than 50 Parker O-ring distributors. You can get standard sizes of AN, MS, industrial specifications, etc., right off the shelf. (And we have over 296 standard O-ring sizes with many different standard compounds.) Parker also has the production facilities to handle "specials" and volume requirements.

From Parker you get exactly the right O-ring for your specific requirements. Our engineering service will help you with any designing problems. We invite you to prove by comparison tests how Parker O-rings seal better and last longer.

Parker
Hydraulic and fluid system components

RUBBER PRODUCTS DIVISION
Section 522-A
The Parker Appliance Co.
17325 Euclid Ave., Cleveland 12, Ohio

☐ Please send O-ring Size Catalog No. 5701

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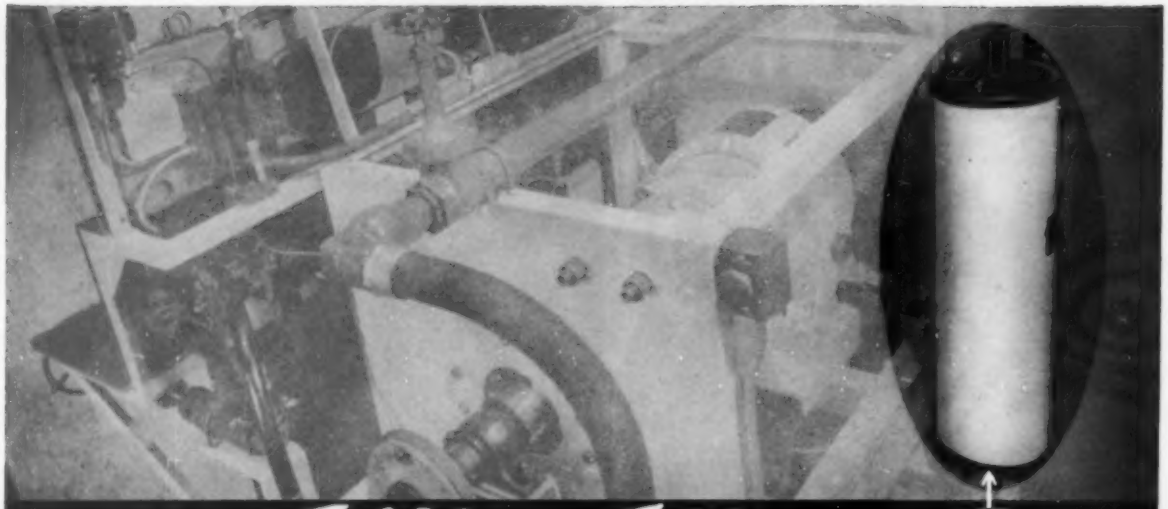
COMPANY _____

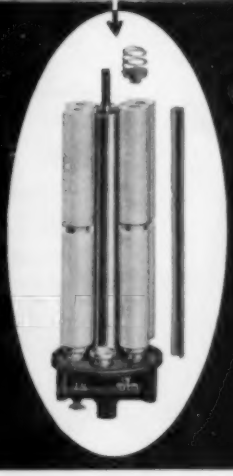
ADDRESS _____

CITY _____ STATE _____



with *Fulflo Filters*
you can maintain micronic clarity for all Hydraulic Fluids.....

* EXTEND FLUID LIFE
* PROTECT PRECISION PARTS
* REDUCE MAINTENANCE COSTS



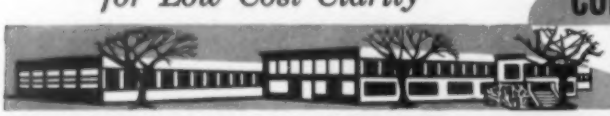
You can make substantial savings in prolonged fluid life, less down time and fewer repairs with Fulflo Filters.

Fulflo Filters are especially designed for micronic clarification of fluids used where exceptionally fine tolerances are involved. Fulflo Filters employ Honeycomb Filter Tubes, in a wide range of positively controlled densities, to give you the exact degree of micronic clarity needed for each operation. Fulflo Filters will *not* remove additives from oils. For replacement, be sure to insist on *genuine* Honeycomb Filter Tubes.

CFC Honan-Crane Hydraulic Oil Purifiers prevent excessive wear of hydraulic parts and prevent clogging of valves and pistons. Filter medium is Cranite (Fuller's earth) for removal of soluble impurities as well as abrasive solids. CFC Purifiers are designed for direct connection to an individual system, as mobile units, or as part of central oil system. They quickly pay for themselves through reduced consumption of oils.

Commercial Filters Engineers are ready to help you with any problems involving fine filtration of hydraulic fluids. Write for technical literature to Department AH.

Micro-Fine Filtration for Low Cost Clarity



COMMERCIAL FILTERS CORPORATION

MELROSE 76, MASSACHUSETTS

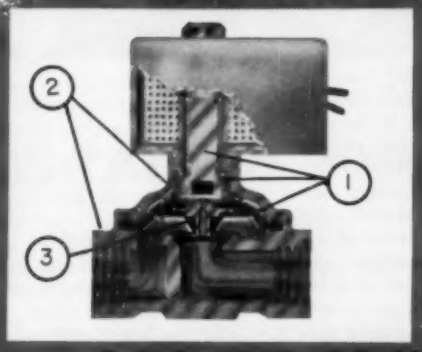
Plants in Melrose, Massachusetts and Lebanon, Indiana

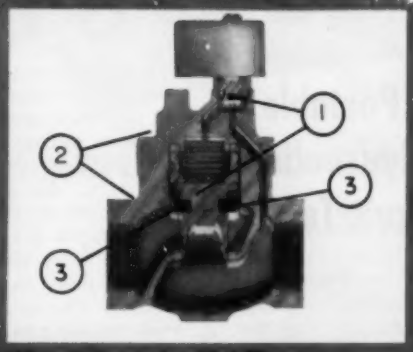
FULFLO FILTERS WITH GENUINE HONEYCOMB FILTER TUBES FOR CONTROLLED MICRONIC CLARITY • CFC MULTI-CARTRIDGE OIL FILTERS
FURIVAC INSULATING OIL CONDITIONERS • DRI-PURE WATER-OIL SEPARATORS • PRE-COAT FILTERS • MAGNETIC SEPARATORS
AUTOMATIC TUBULAR CONVEYORS • COOLANT CLARIFIERS

new complete line of
ASCO 2-way solenoid valves
now available in full range through 3" sizes

Now specifying engineers may select from ASCO's new line of general purpose packless valves in full size range from ⅜ to 3 inches; pressures to 350 p.s.i. Study these valve cross sections and see why ASCO design means dependability in flow-control for air, gas, water, light oil and other non-corrosive fluids.

THE INSIDE STORY OF ASCO DEPENDABILITY





Bulletin 8210A ⅜"–¾" sizes

1. Simplicity in construction. Only three operational parts: all stainless steel core, stainless steel spring, Hycar diaphragm (for handling all common liquids and gases).
2. Ruggedness. Forged brass bonnet and body insure freedom from porosity.
3. Tight Shut-Off. Assured by resilient disc construction.
4. Compactness. 2¾" face to face; 3¼" pipe center line to top of solenoid; 3 13/16" overall height. (Normally closed, ⅜" x ½" sizes.)
5. Mountable in any position, normally open or normally closed.

Bulletin 8210A 1¼"–3" sizes

1. Simplicity in construction. Even in larger port sizes, moving assemblies have been held to two—bronze piston and stainless steel core.
2. Ruggedness. Extra heavy duty bronze body and bonnet, plus heavy duty operating parts.
3. Tight Shut-Off—assured by resilient disc construction.
4. Elimination of water hammer—assured by slotted "V" type discs.

All sizes have full area ports, continuous duty coils designed for low temperature rise and long life, and are available normally open or normally closed with standard, water tight or explosion proof solenoid.

Whatever the crucial factor in your flow-control application—reliability, compactness, high cycling rate—there is an ASCO valve that meets your need.

Write for Catalog 201 covering ASCO line of solenoid valves.

Automatic Switch Co.
50-B Hanover Road, Florham Park, New Jersey
FRontier 7-4600

ASCO

Circle 12 on Reader Service Card

Here's the SCHROEDER 3 way maintenance control system for IMPROVED HYDRAULIC OPERATION

1 *REDUCE the need for repair—*

Schroeder Hydraulic Filter Buggy

Removes troublesome dirt before it can gum up your hydraulic system. Saves oil, cuts pump and system repair costs.

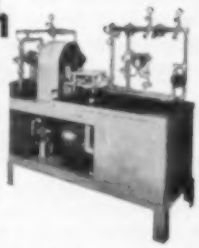
2 *LOCATE trouble at the machine—*

Schroeder Portable Hydraulic Circuit Tester

Does away with time-consuming hunting by quickly pinpointing the trouble spot before removing any component from the machine.

3 *TEST to prove repair—*

Schroeder Hydraulic Test Bench



Removes all guesswork—now you can be sure of the condition of each hydraulic component before it is returned to the machine.

For a smoother flowing hydraulic system use the Schroeder 3 way maintenance control system.

SCHROEDER BROTHERS CORPORATION

McKEES ROCKS, PA. NICHOL AVE. SPaulding 1-4810

HYDRAULIC, ELECTRIC & PNEUMATIC EQUIPMENT

BRIEFS continued

Air Power Automates Rotary Indexed Welding Machine

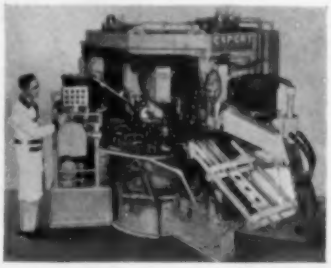
Accurate positioning and welding of nuts or brackets to surfaces of production parts is performed on a 7-station, rotary index, projection welding machine. Expert Welding Machine Company took full advantage of the versatility and flexibility of pneumatics in designing this model.

• **Air operated-electrically controlled**—Machine features a stop and start cam drive mechanism that controls index and weld sequences, bowl feeders equipped with hopper feed tracks, a transfer device for delivering weld nuts to the projection welding guns, and a unique mechanism for projection welding brackets to production parts. An air-powered unloader mechanism automatically removes the finish-welded assemblies from the machine and deposits them on a conveyor.

Model illustrated projection welds two tee nuts, three weld nuts and a steering stop bracket, to automotive suspension arm assemblies, at a rate of 400 per hour.

• **Fast, Automatic Operation**—Parts to be welded are manually loaded into the fixture at station one. Parts are then automatically indexed to station two.

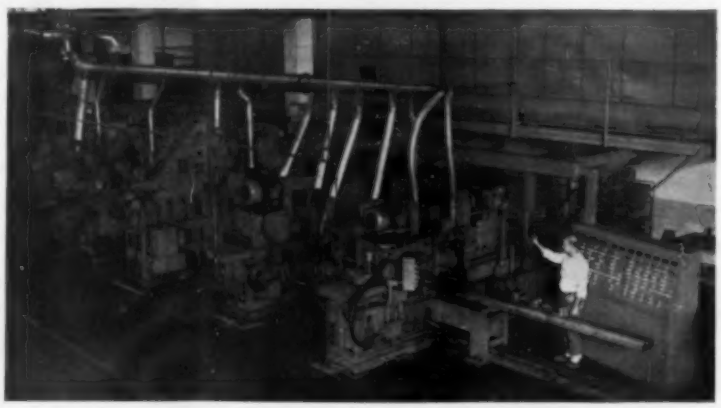
In the third station a vibratory hopper feeds the tee nuts to two hopper feed tracks from which two



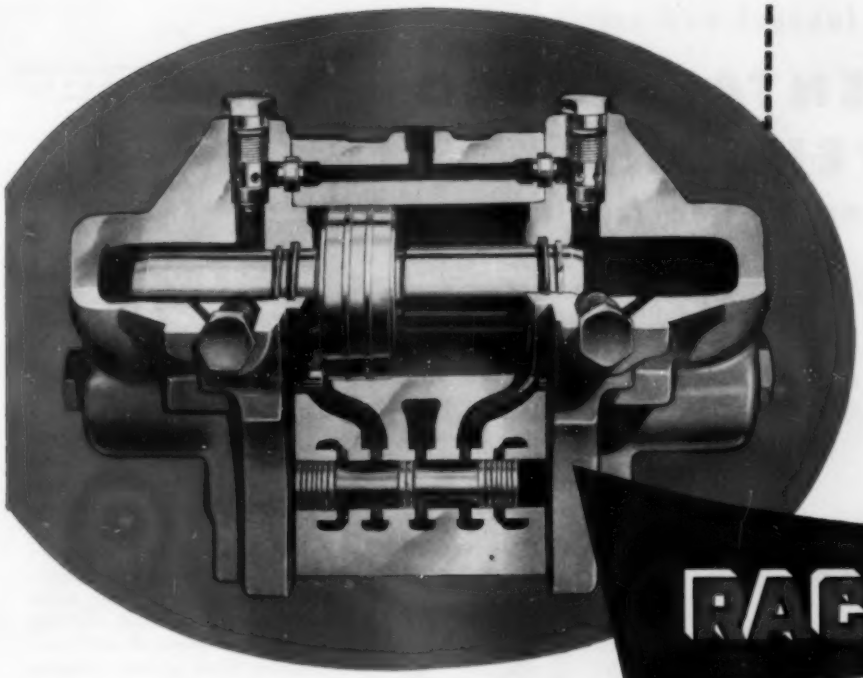
horizontal air-operated mechanisms automatically transfer the tee nuts to spring clips located on the electrodes of the welding guns. Two overhead air-operated welding guns then move downward, correctly positioning the tee nuts and welding them in place. An overhead air-powered hold down cylinder holds the part in place during this operation.

In the fourth station, a steering stop bracket is manually loaded into the fixture. Three weld nuts,

Continued on page 44



This hydraulically actuated transfer machine built for Reliance Electric and Engineering Company faces, bores, mills, drills and taps motor frames. It uses a motor driven hydraulic actuating mechanism. A hydraulically operated shuttle transfers the castings from station to station. This machine does the work of a milling machine, eleven vertical turret lathes, a multiple spindle drill. The transfer machine requires less space, and fewer operators than the equipment it replaces.



RACINE®

HYDRAULIC PRESSURE BOOSTERS

HIGH PRESSURE VALUES— AT LOW PRESSURE COSTS

This patented RACINE PRESSURE BOOSTER builds pressures as high as 5000 psi. With it you can economically multiply the pressure from your low pressure pump as much as seven to one

It allows you to use low pressure at low cost for many operating and closing actions. High pressures to 5000 psi, automatically cut in for final forming and holding operations, or curing cycles on your machine.

Simple design, pressure lubricated, rugged parts and the use of extremely high tensile materials make RACINE Pressure Boosters practically indestructible They last for *years and years* with little maintenance or repair.

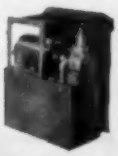
If you need pressures to 5000 psi, write us now. Learn how you can have "High Pressure Values at Low Pressure Costs."

OTHER RACINE HYDRAULIC PRODUCTS

MODEL Q
Variable Volume
Vane Type
Hydraulic Pump

4-WAY VALVE
Twin Solenoid
Pilot Operated

FLUID MOTOR
Vane Type
50 to 3500 rpm
Pressures to 1500 psi



RESERVOIR
With Control Panel
Designed to your space
and circuit requirements

RACINE

NFPA NATIONAL FLUID POWER ASSOCIATION

RACINE HYDRAULICS & MACHINERY, INC.
2074 Albert Street
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you can inspect and service

CONTINENTAL-EMSCO SWIVEL JOINTS

without removing from the line!

long life—easy turning
no expensive returns
to factory for repairs

Continental-Emsco Swivel Joints save you time, money and trouble. After long service, both the packing and the ball races are easily replaceable. You can inspect and service them easily by breaking the joint as you would a pipe union. No costly return to the factory for repairs. Available in 8 basic styles and over 500 models.

Complete information on request.

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Serving the Oil and Gas Industries ... Worldwide

CONTINENTAL-EMSCO COMPANY
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Export Representative, R. J. Dicke & Associates, Inc.
10 Columbus Circle, New York 19, N.Y.

BRIEFS continued

fed through two vibratory hoppers, and three feed tracks, are projection welded to the part in the fifth station.

At the sixth station, the steering stop bracket is projection welded to the outside edge of the suspension arm. An overhead hold down and locator cylinder accurately locates this bracket on the part. Two pinch guns, each one operated by a lever arrangement and an air cylinder, move upwards from below the index table and weld bracket to the outside surface of the suspension arm assembly.

Part is automatically unloaded at seventh station by two air-operated unloader arms that move radially inward through the fixture. The air-powered unloader mechanism then pivots, moving the arms upward, and strips the finish-welded assembly from the fixture. Assembly then slides outward and downward from the machine to a conveyor. ▼▼▼

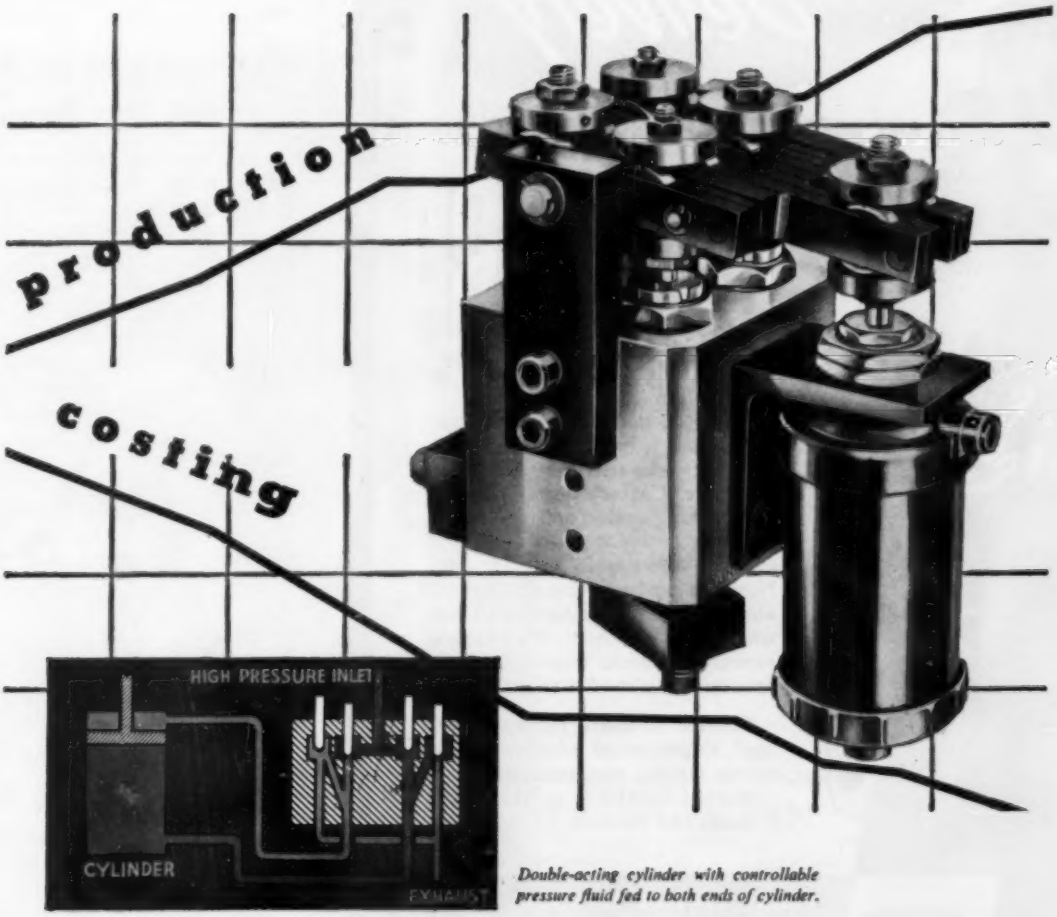
Hydraulic Press Has Absolute Control

This goose-neck type hydraulic press for pressures from a gentle pinch to a 200 ton squeeze was

built by Fjellman American Inc., Joliet, Ill. The press loads from any position within a 300 degree arc, with all controls and gages located so the operator has absolute control of the job.

Continued on page 46

AUTOMATION at low cost



Double-acting cylinder with controllable pressure fluid fed to both ends of cylinder.

Operating in conjunction with timing instruments, Ellison Hydraulic Valves provide Automation with little capital outlay—enabling several hydraulically operated machines to be controlled automatically by a single operator. Further, arrangements can be made for automatic control of machine safety guards to comply with Factory Act regulations. Ellison Valves mark a real step forward in hydraulic practice.

They embody new features to prevent scoring of seats and stems and to ensure trouble-free service with little maintenance.

Send for full details and ask to see a Valve.

Made by

GEORGE ELLISON
LIMITED

PERRY BARR BIRMINGHAM 22B.
ENGLAND

.806

Let us take over your inventory problem!

Immediate Delivery

ANY BORE SIZE • ANY MOUNT • ANY STROKE

CARTER
CYLINDERS

Sounds too good to be true, but here's real help for engineers and designers who need fast action on cylinders. Carter's exclusive key type locking design and simplicity of parts *makes it possible to ship cylinder orders in 24 hours or less!* Now you can have rugged, dependable, compact quality cylinders when you want them. We produce around the clock. Your order is in process *minutes after we get it.*

Service on spare parts is good too! Experienced engineers and parts stocks are located in 40 different locations in the U. S., Canada and Mexico.

PHONE SERVICE 24 HOURS A DAY
Orders taken day or night. If you need fast service call your Carter representative or the plant
LANSING, ILLINOIS, GRanite 4-3305 or CHICAGO, EAvpark 1-7126. Teletype LNSG ILL 1119X

Complete Catalog File!

Complete bound file with ordering details for: Air Cylinders; 750 Lb. Hydraulic; 1500 Lb. Hydraulic; Clamp Cylinders; Air Valves; Built-in Valve Type Cylinders. Complete with parts data, specifications and prices. Send today!

CARTER CONTROLS INCORPORATED
3972 Bernice Road • Lansing, Illinois (Chicago Suburb)
AIR CYLINDERS • HYDRAULIC CYLINDERS • AIR VALVES
ROTARY ACTUATORS • SPECIAL CONTROLS

BRIEFS continued

The massive frame houses the two-stage hydraulic pump, oil reservoir, and other hydraulic components. The cylinder and piston rod are ground to a mirror finish to assure long, trouble-free operation. ▼▼▼

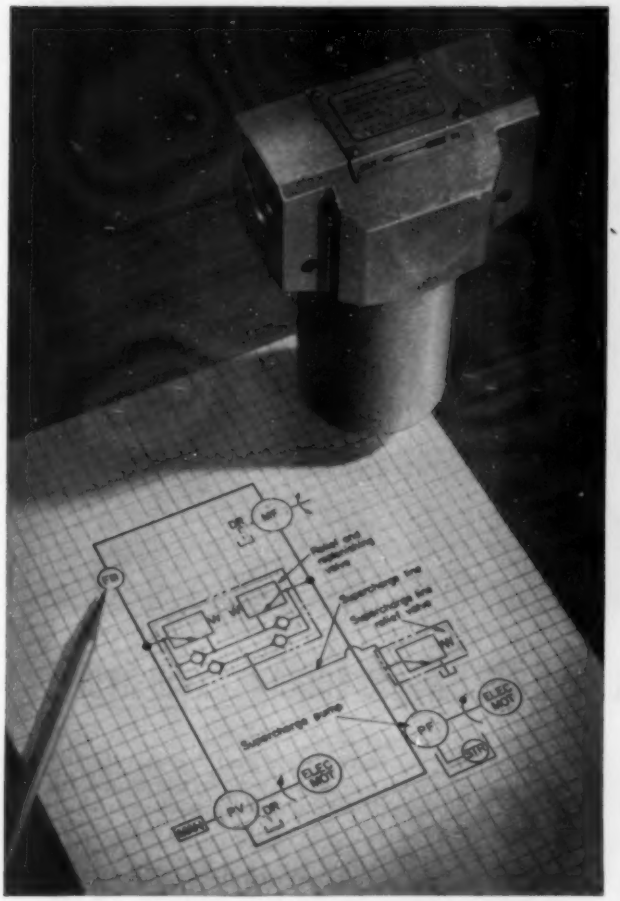
Hydraulic Cylinder Powers Side Dumping

Side-dumping the bucket of Caterpillar Tractor Company's Traxcavator is accomplished by the use of a hydraulic cylinder mounted on the bucket carriage. The bucket is hinged to the carriage and firmly locked in place when in conventional digging position. When side dumping is desired, the operator actuates the hydraulic cylinder by a control lever, situated to his right, on the hydraulic tank.

When actuated, the dumping cylinder unlocks the bucket from the bucket carriage and swings it into a side dumping angle of 60 degrees. A third hydraulic valve, easily installed in the machine's hydraulic system, controls the dumping cylinder.

The cylinder is protected by a reinforced plate steel shield mounted on the rear of the bucket. With the hydraulic cylinder providing the necessary power for the side dumping, less space is required. Installation and removal of the attachment is simple and fast and does not interfere with the use of other attachments. ▼▼▼

Filters put performance into this adjustable-speed hydraulic transmission circuit



For applications requiring any combination of torque and horsepower characteristics, an adjustable-speed hydraulic transmission consisting of a variable-delivery pump and variable-displacement fluid motor is generally used. In a reversing adjustable-speed hydraulic transmission circuit, either pump line may be the intake side. This type of transmission can be used to advantage in applications requiring a wide speed range. Over-all efficiency for this type of hydraulic transmission is approximately 85 per cent for all output speeds greater than 30 per cent of maximum.

In development of variable-speed transmission circuits, the rules and factors governing the design of hydraulic circuits in general apply. Protection of hydraulic fluid from contamination is essential for dependable performance of the circuit. And Purolator filters provide the most effective protection available today. The unit shown (PR-412-8) is used in many circuits like that above. It is part of a series offering a range in nominal rated capacity from ½ to 12 gallons per minute. The case can be unscrewed and removed for replacement of the element without disturbance to connections. To improve your hydraulic system, get precisely the filter you need by contacting Purolator.

THIS CIRCUIT incorporates a supercharge pump and a reversible replenishing system. Supercharging increases capacity of the main pump by maintaining pressure at the pump inlet and removing the possibility of cavitation at high flow rates. The supercharge pump has its own relief valve which limits inlet pressure to the main pump to approximately 150 psi. The relief and replenishing valve is a single unit which because of the arrangement of the check valves admits fluid to the system on the low-pressure side of the main pump but does not permit fluid pressure to be lost from the high-pressure side despite flow reversal.

Filtration For Every Known Fluid

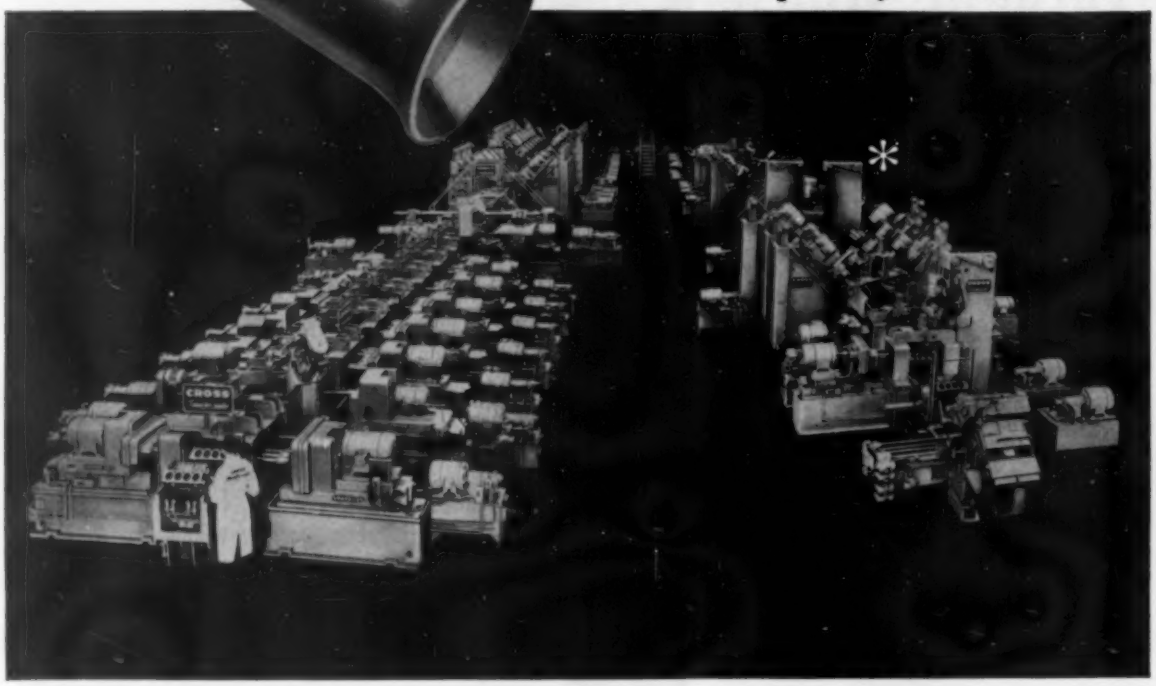
PUROLATOR

PRODUCTS, INC.

Rahway, New Jersey and Toronto, Ontario, Canada

HYDRAULICS in AUTOMATION

No place for down-time



that's why **CROSS** specifies HYDRALUSTER tubing exclusively!

Hydraluster tubing is carrying the vital load of hydraulic transmission in this 350 ft. Cross transfer machine. Hydraluster is there because *every* part and assembly has to be 100 per cent dependable. There is too much at stake for anything less.

Why does Hydraluster get the call? . . . because it is a revolutionary improvement over any previous type of hydraulic tubing. *Inside*, Hydraluster has a new type of tubing surface, very much like a gun barrel. This smoothness cuts friction and heat, and the result is higher power efficiency and lower reaction times. This new surface is also highly resistant to oxidation and scale . . . added protection for valves, pumps and meters.

Here we quote Mr. Ralph E. Cross, Executive Vice President of The Cross Company. "*We've used Summerill Tubing for years because we felt it was the best. And when Summerill topped even their best with Hydraluster, it was only logical that we go along with the improvement.*"

*Stations—104. Operations—265 drilling, 6 milling, 21 boring, 56 reaming, 101 countersinking, 106 tapping, and 133 inspection.

SAMPLES and SPECIFICATIONS: Examine Hydraluster right at your desk or board. Your name on company stationery will bring samples and specifications.

Summerill

Tubing Company Division-Columbia Steel & Shafting Co.

PITTSBURGH 30, PA. DEPT. NO. 5-10

District Offices: Buffalo • Chattanooga • Chicago • Cleveland
Dayton • Hartford • Los Angeles • Philadelphia • Pittsburgh • Milwaukee • San Francisco

Pictured above is the Ajax Engineering Corporation 60-cycle coreless induction melting furnace recently installed in the Ajax experimental foundry. The unit is used to demonstrate operating characteristics and versatility of the new furnace type and to explore new fields of application.

As leaders in 60-cycle induction melting, Ajax seeks to make its equipment as safe as possible. Hydraulic tilts for efficient, sensitive handling are standard components, and inclusion of fire-resistant Pydraul is another step toward protection of life and property.

Fire-resistant Pydraul assures safe operation in Ajax furnace "heat zone"

Tons of molten metal are poured into Ajax melt and hold furnaces daily . . . and this means extremely high temperatures. Sparks and flames can leap surprising distances and cause serious fires: a major reason why Ajax equips its hydraulic systems with fire-resistant Pydraul hydraulic fluid. Pydraul lubricates like a premium petroleum oil, has a longer service life than most fluids . . . and saves money because it can be reclaimed.

Pydraul F-9 is the only fire-resistant hydraulic fluid listed with Underwriters' Laboratories.

Like Ajax—*you* can depend on fire-resistant Pydraul . . . the thoroughly efficient fluid that goes a step further . . . eliminates needless fire risks in your plant. Have your Monsanto representative show you how easy and economical it is to change to a firesafe Pydraul system.

Pydraul: Reg. U. S. Pat. Off.

Write for Pydraul F-9 booklet . . .
Organic Chemicals Division
MONSANTO CHEMICAL COMPANY
Dept. OEM-11, St. Louis 1, Missouri

MONSANTO

WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU

Useful Literature

For your free copy of publications reviewed, fill in the reader service card

OIL FILTERS . . . featuring a throwaway cartridge, are described in Bulletins F-135, F-153 and F-154, released by The Hilliard Corporation. Filters were designed for filtration of lubricating oils, industrial oils, and for oil-bath air filters. Simple, three-piece construction permits easy servicing. Bulletins give specifications, application data, flow rate, pressure and viscosity data.

Circle 210 on Reader Service Card

HYDRAULIC POWER UNITS . . . and test stands, manufactured by J. N. Fauver Co., Inc., are illustrated and described in their 8-page Catalog H-257. Standard and special power units are covered, as well as general-purpose test stands and those for special applications. Engineering drawings are included on the standard power units and accessories.

Circle 211 on Reader Service Card

SMALL BORE CYLINDERS . . . for pneumatic applications are covered in Bulletin 91000 available from Airmatic Valve, Inc., Cleveland. Bore sizes are: ⅜, ½, ¾ and 1⅛-in. These small size cylinders should be especially suitable for automation and control applications. Bulletin gives complete technical data and dimensional drawings.

Circle 212 on Reader Service Card

HYDRAULIC CONTROL VALVES . . . featuring miniature steel bodies, are produced by Adel Precision Products Div., General Metals Corp., Burbank Calif. The ¼ in. tube size is 2.57 in. wide by 3.27 in. long. Available bulletin gives detailed information and specifications, with dimension drawings, illustrations, and graphs giving flow rates in gpm versus pressure drop and temperature rise versus time. Basic units are 3-position, 4-way, solenoid, pilot-operated, directional control valves. Variations include 3-position, 4-way with manual over-ride on the solenoid, or on the piston, 2-position, 4-way, solenoid, pilot-operated, and 2-position, 4-way, solenoid, pilot-operated, with manual over-ride on the solenoid.

Circle 213 on Reader Service Card

MECHANICAL PACKINGS . . . fabricated from Teflon are described in brochure P-325 from Crane Packing Co. Service and technical details on chemically inert Chemlon mechanical packings are included. Fifteen types of braided construction, six types of molded construction, cup and cone rings and combination sets are discussed. The brochure gives recommendations for services, applications and temperatures. Information on pressures, dimensions and mechanical requirements is also provided.

Circle 214 on Reader Service Card

AIRCRAFT CATALOG . . . is convenient to use and covers the full range of Aeroquip Corp. products. It includes low, medium, and high pressure hoses with detachable, reusable fittings for air, water, fuel, lube and hydraulic applications, and features their self-sealing couplings and accessories. 88 page catalog 101 also provides answers to fluid line problems encountered by designers, and supplies useful data on bend radii of hoses, installation techniques, and assembly procedures.

Circle 215 on Reader Service Card

GAGE GUARD . . . for protecting sensitive pressure instruments, is manufactured by Industrial Engineering Corp., Louisville, Ky. Bulletin 541 G gives specifications and technical data, along with illustrations and schematic drawings. Unit is simply installed in the line between the pressure instrument and the source of pressure. Standard synthetic rubber internal parts are resistant to aqueous and hydraulic oils.

Circle 216 on Reader Service Card

AIR COMPRESSORS . . . are listed in consolidated data sheet issued by Brunner Mfg. Co., Utica, N. Y. All models are covered with specifications and information on sizes ¼ through 20 hp, including single and two-stage units for all applications.

Circle 217 on Reader Service Card

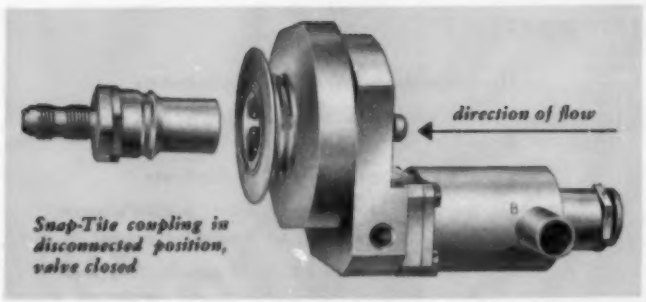
HYDRAULIC PUMPS . . . manufactured by Watson-Stillman Fittings Div., H. K. Porter Co., Inc., are described in Bulletin A-5. The line includes independent-pump hydraulic jacks, single and double-plunger hand pumps, and double-acting air engine pumps for horizontal and vertical operation. Booklet gives detailed information and specifications on available units, and indicates applications for their use.

Circle 218 on Reader Service Card

For more reviews of FREE LITERATURE turn to page 148

Circle 115 →

SNAP-TITE REMOTE CONTROL COUPLINGS FOR GUIDED MISSILES



Snap-Tite coupling in disconnected position, valve closed

Here is a specially designed Snap-Tite quick-connect, quick-disconnect coupling, ideal for use in missile-fueling systems. This unit is specifically designed to be manual-connected . . . can also be disconnected manually, or by use of an air-actuated remote control.

NOT A DROP SPILLED!

When the coupling is disconnected, it spills only that small amount of fluid which clings to the metal. The valves in both the coupler and nipple automatically shut off when disconnected, *with no leakage.*

NO AIR INCLUSION!

Coupling operation encloses only a minute amount of air.

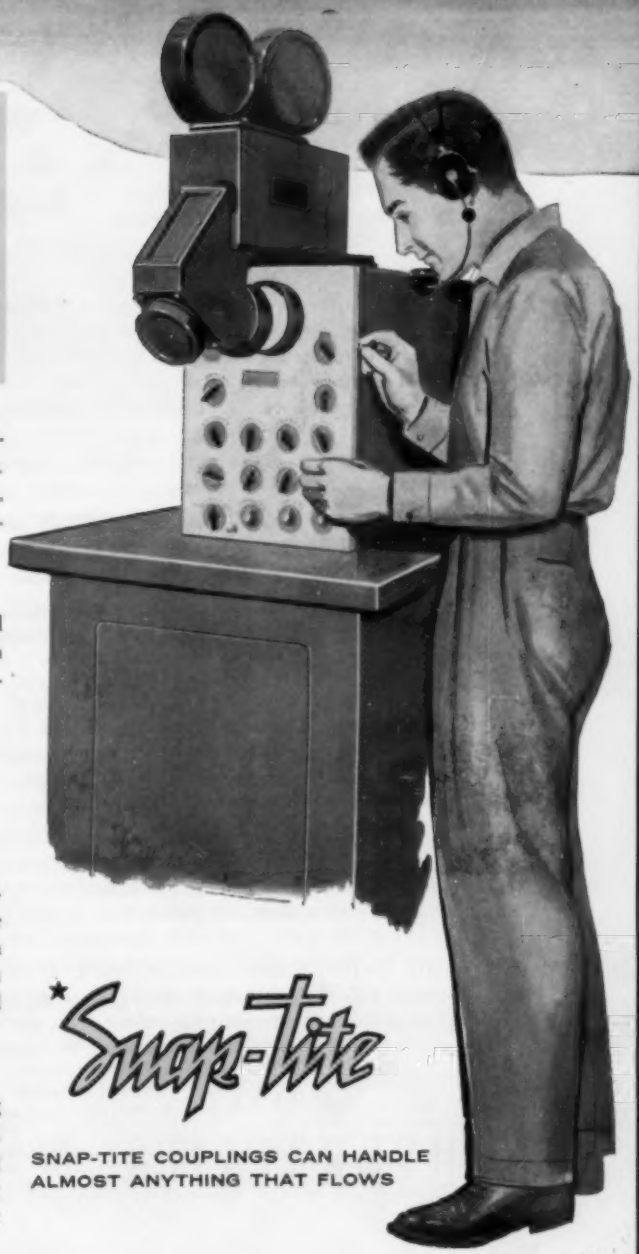
MINIMUM PRESSURE DROP!

Smooth, streamlined passages assure maximum flow.

Variations of this coupling, to meet your required specifications, can be furnished with the appropriate seals to handle liquified gasses, exotic fuels, and a large variety of fluids with working pressures up to 3,000 PSI and temperatures from −300°F to +400°F. Units have been designed up to and including 5″ size.

STANDARD COUPLINGS, TOO!

Your coupling needs might not be as critical as the coupling shown here, but you can be sure, when buying standard Snap-Tite couplings, that the same outstanding engineering and manufacturing skills are basic throughout the Snap-Tite line. Write for complete catalog . . . or describe your specific coupling problems. Snap-Tite, Inc., Union City 1, Pa.



★Snap-tite

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

1957 FLUID POWER PRIZE PAPER CONTEST

CONTEST CLOSES JULY 1, 1957

First Prize $500

Second Prize $300

Third Prize $200

4th to 7th Prizes, each . . $50

CONTEST RULES

PURPOSE: The purpose of this competition is to recognize and reward achievement in the field of fluid power design and application.

SUBJECT OF ENTRIES: Papers can deal with any phase of product or equipment development in the fluid power field; descriptions of new applications of hydraulics and pneumatics; efficient maintenance and trouble shooting programs; construction techniques used on fluid powered machines; production and automation improvement obtained by use of fluid power; circuit improvements; machine conversions.

All papers must be original and expressly prepared for entry in this contest.

Papers may be co-authored.

Where required, company clearance for publication must be obtained by the author before submitting the paper.

WHO MAY ENTER: All readers of APPLIED HYDRAULICS Magazine whose work has helped to promote the advancement of hydraulics or pneumatics are eligible.

CRITERIA FOR AWARDS: Judges will evaluate papers on the basis of practicality, economics, originality, and presentation for publication.

HOW TO ENTER: Papers must be typed, double-spaced, on 8½ x 11 sheets. Inclusion of glossy photographs is recommended along with pertinent circuit, layout, and component drawings. Drawings should be prints or photostats.

Where applicable, tables, charts and graphs should be included.

Papers must be submitted in duplicate.

On the title sheet for each entry, author's name, position, company and address must appear.

There is no limit to length of article. Any issue of APPLIED HYDRAULICS will serve as a guide to presentation.

Submit all entries to:

Editor
APPLIED HYDRAULICS Magazine
812 Huron Road
Cleveland 15, Ohio

PRESENTATION OF PRIZES: As in past years, arrangements will be made to present cash awards to the three top winners at a luncheon meeting of the National Conference on Industrial Hydraulics in the Fall of 1957. The three top papers will be published in the APPLIED HYDRAULICS Conference Issue, October 1957.

STATUS OF SUBMITTED PAPERS: All papers winning cash prizes and awarded honorable mention become the property of APPLIED HYDRAULICS Magazine to be scheduled for publication by its editors. After publication, permission for reprinting or presentation before technical groups will be granted.

All entries will be acknowledged.

CLOSING DATE: July 1, 1957

APPLIED
HYDRAULICS

THE MAGAZINE OF FLUID POWER

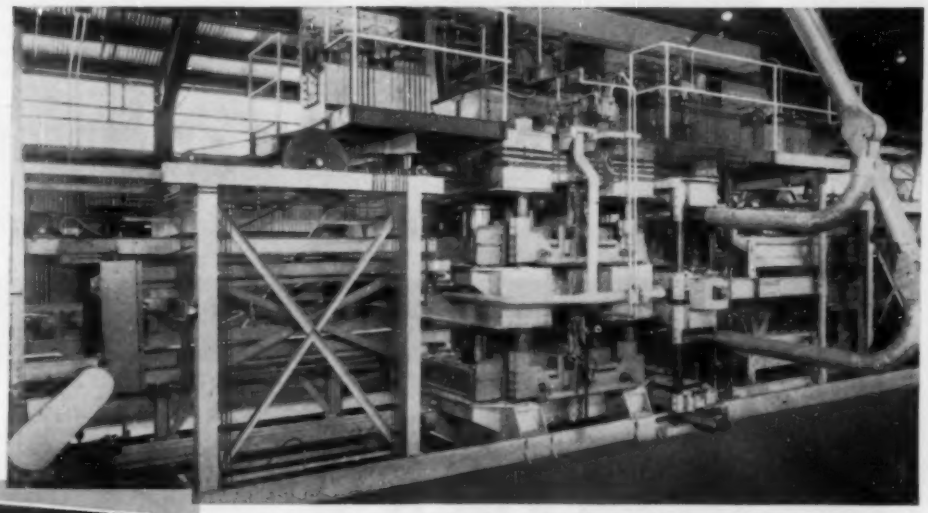
812 Huron Road • Cleveland 15, Ohio

AUTOMATION

IN HARDBOARD PRODUCTION

With VICKERS® HYDRAULICS

REDUCES COSTS • IMPROVES UNIFORMITY • PROVIDES FLEXIBILITY

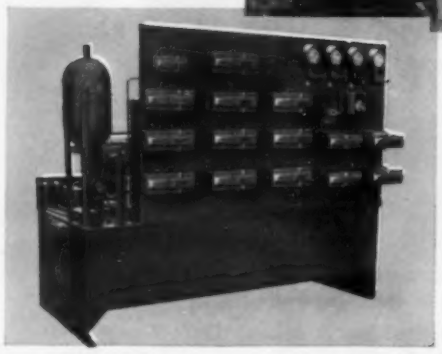


Prepress area of automatic hardboard plant designed and built as a package unit by the Industrial Development Company, Tacoma, Washington for Columbia Hardboard Company, Inc.

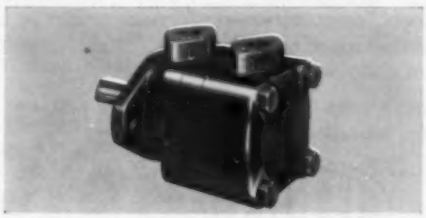
Reported to be the most highly automated in the wood products industry, this plant produces 60,000 sq ft of "Cedawood" per day (½" basis).

Seven Vickers Custom-Built Hydraulic Power Units play an important part in this performance; four are shown (in the photograph above) mounted on the platform directly above the prepress. The other three operate a series of automatic transfer systems in various parts of the plant. The transfer drives also use Vickers Vane Type Hydraulic Motors, which provide easily controlled variable speed for synchronizing various operations and for overload protection.

The use of hydraulic variable speed drives makes it easy to vary production rate, flakeboard thickness (⅛" to 1"), and type of product. Additional features are: accurate control, simplicity of installation, and low maintenance. For further information about the many benefits you get from Vickers Hydraulics, ask for Bulletin 55-67.



This Vickers Custom-Built Power Unit is individually designed to meet specific needs. It assures dependable performance, improves and simplifies design, reduces installation time and cost, and makes servicing easier. Write for Bulletin 52-45.



The performance-proven Vickers Balanced Vane Type Hydraulic Motor is an economical, efficient, and compact means of providing variable speed rotary power. It can be used for reversing service and can be stalled under load without damage. Write for Bulletin I&M-5103.

7834

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division

ADMINISTRATIVE and ENGINEERING CENTER
Department 1474 • Detroit 32, Michigan

Application Engineering Offices: **ATLANTA • CHICAGO • CINCINNATI CLEVELAND • DETROIT • GRAND RAPIDS • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N. J.) PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) PORTLAND, ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA • WORCESTER**
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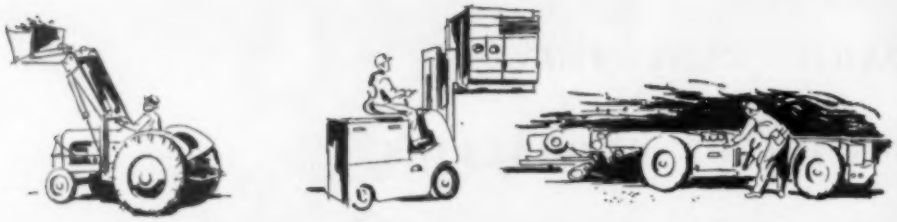
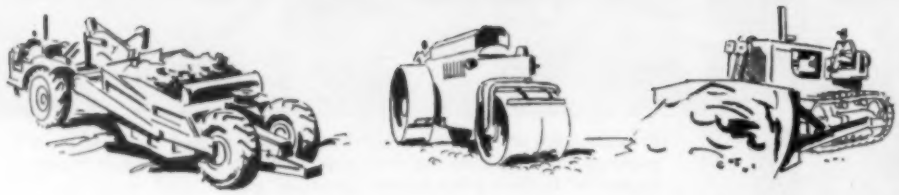


ENGINEERED HYDRAULIC CYLINDERS



by LEWIS

CUSTOM UNITS

DESIGNED AND MANUFACTURED

TO PRECISION TOLERANCES

...FOR YOUR EQUIPMENT

If your product uses custom or specialized hydraulic cylinders, LEWIS can *design* and *manufacture* dependable precision units to meet your requirements or specifications.

Single and double-acting cylinders . . . piston, displacement and telescoping cylinders . . . can be supplied in production quantities in a wide variety of sizes and capacities.

LEWIS' integrated and experienced design-engineering and fabricating facilities assure rigid quality control . . . extreme accuracy . . . prompt delivery . . . competitive prices. That's why manufacturers of machine tools, construction equipment, materials handling trucks and mining machinery specify LEWIS for custom hydraulic cylinders of all types.

WRITE TODAY FOR DETAILS... or call KEnmore 1-3040 for immediate information.

7457-LWM

LEWIS

THE LEWIS WELDING & ENGINEERING CORP.
MACHINE DIVISION
22987 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

Circle 68 on Reader Service Card

UNMATCHED FOR POSITIVE HIGH PRESSURE CONTROL

ERMETO®

ERMETO 8000 SERIES

Steel or stainless steel fittings in sizes and types to meet any need. No flaring, threading, welding or soldering.

ERMETO 7000 SERIES

Meets new S.A.E. Boss Specifications. Permits closer couplings, higher pressures. Weathercote finish resists corrosive elements.

Introduced by Weatherhead nearly a quarter century ago, Ermeto continues to top the list as industry's most popular high pressure flareless tube fitting. Assures better service in every field where hydraulic power is applied. Distributors coast to coast.

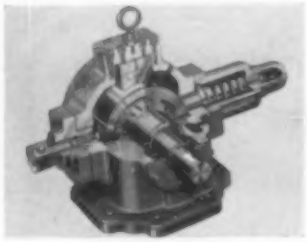
WEATHERHEAD

FIRST IN HYDRAULIC CONNECTIONS
THE WEATHERHEAD CO., FORT WAYNE DIVISION
Dept. A-6, 128 West Washington Blvd., Fort Wayne, Indiana
In Canada: The Weatherhead Co., Ltd., St. Thomas, Ontario

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

VARIABLE VOLUME PUMP . . . has volume selector



Designation: Model R

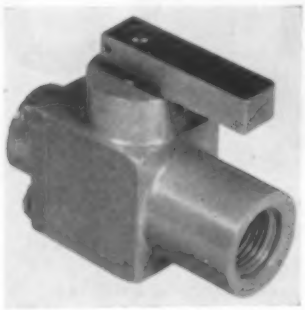
Features: Designed to JIC standards, these sub-plate mounted hydraulic pumps are ideally suited for use in machine tool feed systems, hydraulic presses and mobile equipment. Automatic selection of two separately adjustable pressures is obtained by hydraulic or electrically controlled pressure compensating pump governors. Units offer greater circuit efficiency and a simple, low-cost pump unloading method.

Specifications: Pump delivers 40 gpm at 1200 rpm. Unit is designed for 1000 psi continuous operating pressure, and 1250 psi at intermittent operation. A volume selector adjustment is provided as standard equipment to manually adjust the pump delivery to the exact circuit requirements.

Racine Hydraulics & Machinery, Inc.
Racine, Wis.

Circle 150 on Reader Service Card

STRAIGHT-THRU BALL VALVES . . . feature easy control



Designation: Flo-Ball

Features: Valves are smallest and lightest available for operation in the 3000 psi range. Precision design of sealing arrangement results in minimum torque required and permits quick, easy operation of the valve handle. Unit design gives self-wiping, self-lapping action for long life and low maintenance. Ball and seat are always in positive contact, and not affected by vibration, shock, or acceleration.

Specifications: Bubble-tight flow control at 3000 psi. —320 to 650 F operating temperatures. Unobstructed, straight-through design assures smooth flow and zero relative pressure drop at all flow rates. Suitable for most media, including hydraulic fluids and air, units are available for lines from ¼ to 4-in. Typical ⅜-in. model weighs only 0.3 lbs.

Hydromatics, Inc.
Cedar Grove, N.J.

Circle 151 on Reader Service Card

AIR & OIL CYLINDERS . . . are easily serviced

Designation: Type B

Features: Designed to be compact and easy to disassemble by fastening the heads squarely and rigidly to the tube with commercial rectangular section, hardened steel snap rings reground flat and parallel.

Specifications: Cylinders are for pneumatic or hydraulic service and are available in bores of 1-½, 2, 2-½, 3 and 4 inches, with single or double end rods. All sizes are also available as double-acting or single-acting, spring-return types. Units have either brass or steel barrels, treated for corrosion resistance; stainless steel rods; nylon bearings. Cushions are available for both ends, and interchangeable foot, flange, and swivel mounts permit mounting in any position.

A. K. Allen Co.
Brooklyn, N.Y.

Circle 152 on Reader Service Card

Continued on page 58

It's the BALANCED Synclinal DESIGN

SUMP TYPE (Cutaway)

LINE TYPE (Cutaway)

that makes MARVEL SYNCLINAL FILTERS AMERICAN INDUSTRY'S A-1 CHOICE

In the plants of America's industrial giants, as well as in smaller plants, Marvel Synclinal Filters are installed on all types of hydraulic and other low pressure liquid circulating equipment. Marvels are chosen because of their excellent performance in protecting machines and increasing production by reducing down time. They are proving again and again, their superiority in the one real test—ON THE JOB! The BALANCED Synclinal Design of Marvel Filters provides that all-important balance between maximum ACTIVE filtering area and sufficient storage space for filtered out particles—therefore, longer periods of productive operation are attained at the absolute minimum of maintenance. They meet J. I. C. Standards.

EASY MAINTENANCE—Both sump and line type filters may be easily disassembled, thoroughly cleaned and reassembled by any workman, on the spot, in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

Not only plant operators, but also, OVER 750 ORIGINAL EQUIPMENT MANUFACTURERS have recognized the superiority of Marvel Synclinal Filters and now install them as standard equipment.

SPECIFY MARVEL SYNCLINAL FILTERS ON NEW EQUIPMENT-- STANDARDIZE WITH MARVELS ON EXISTING EQUIPMENT

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G. P. M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

IMMEDIATE DELIVERY!

As in the past, Marvel continues to offer Immediate Delivery

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

Catalogs containing complete data available on request

MARVEL ENGINEERING COMPANY

7227 N. Hamlin Ave., Chicago 45, Ill. **PHONE: Juniper 8-6023**

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated: (AH-6)

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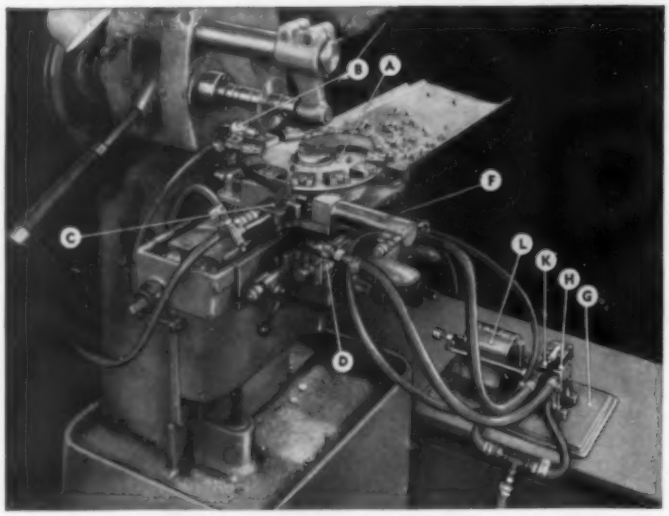
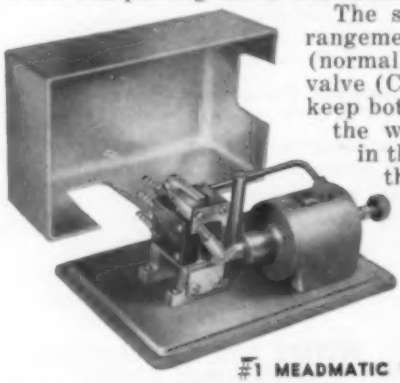
Automation with Air Power



Five standard Mead units converted this hand milling machine into a semi-automatic machine to mill a slot in threaded brass valve plugs, increasing the production from about 375 per hour to more than 1200.

The mill table is moved forward and back by an air cylinder with 1½" bore and 5" stroke, and during each cycle the Rotary Table discards the finished part and indexes a new part to the work station. The Meadmatic Timer is the "brains" of this hookup, delivering air at the right instant to the feed cylinder (D) and consequently to the Rotary Table, (A) and the work-holding cylinder (B). The problem was how to synchronize the motions so that the dial of the rotary table would not rotate while the work was passing under the cutter.



The solution was in the arrangement of limit valve (F), (normally "on") and auxiliary valve (C) normally "off", which keep both the Rotary Table and the work holding valve (B) in the locked position while the mill table moves forward and back; but when the mill table returns to its starting point (A) and (B) are momentarily released to index to the next station.

#1 MEADMATIC TIMER

Write to Factory or Nearest Mead Representative for Bulletin AH-67

See Alphabetical index Thomas' Register for nearest Mead Man Address or Phone Number.

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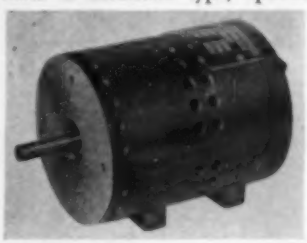
Designation: Type A

Specifications: Unit is a 5500 rpm, 8-pole, aircraft motor suitable for pump and actuator applications. Motor is induction type, operates



on 3-phase, 400 cycle, 200 volt ac, and delivers ½ hp continuously to 50,000 feet altitude. Weight is only 4½ lbs. Unit is flange mounted to the driven equipment and provided with extended or standard shaft. Pads are furnished on the side of the motor for mounting accessories.

U. S. Electrical Motors, Inc.
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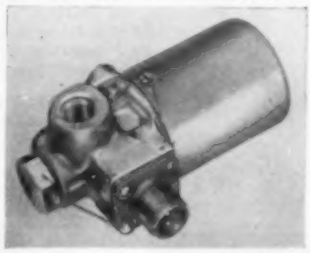
TWO-WAY SOLENOID VALVE
. . . operates at 6000 psi

Designation: MV100

Specifications: Unit weighs only 0.70 lb and has a flow area of approximately 0.125 sq in. Changing the seal material makes the valve



usable with almost any fluid. Operates on 28 dc, but can be made for 124, 400 cps, ac. Furnished either normally open or normally closed, with forged body, stainless interior. Ports conform to AND 10050-4.

Marotta Valve Corporation
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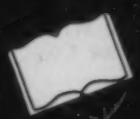

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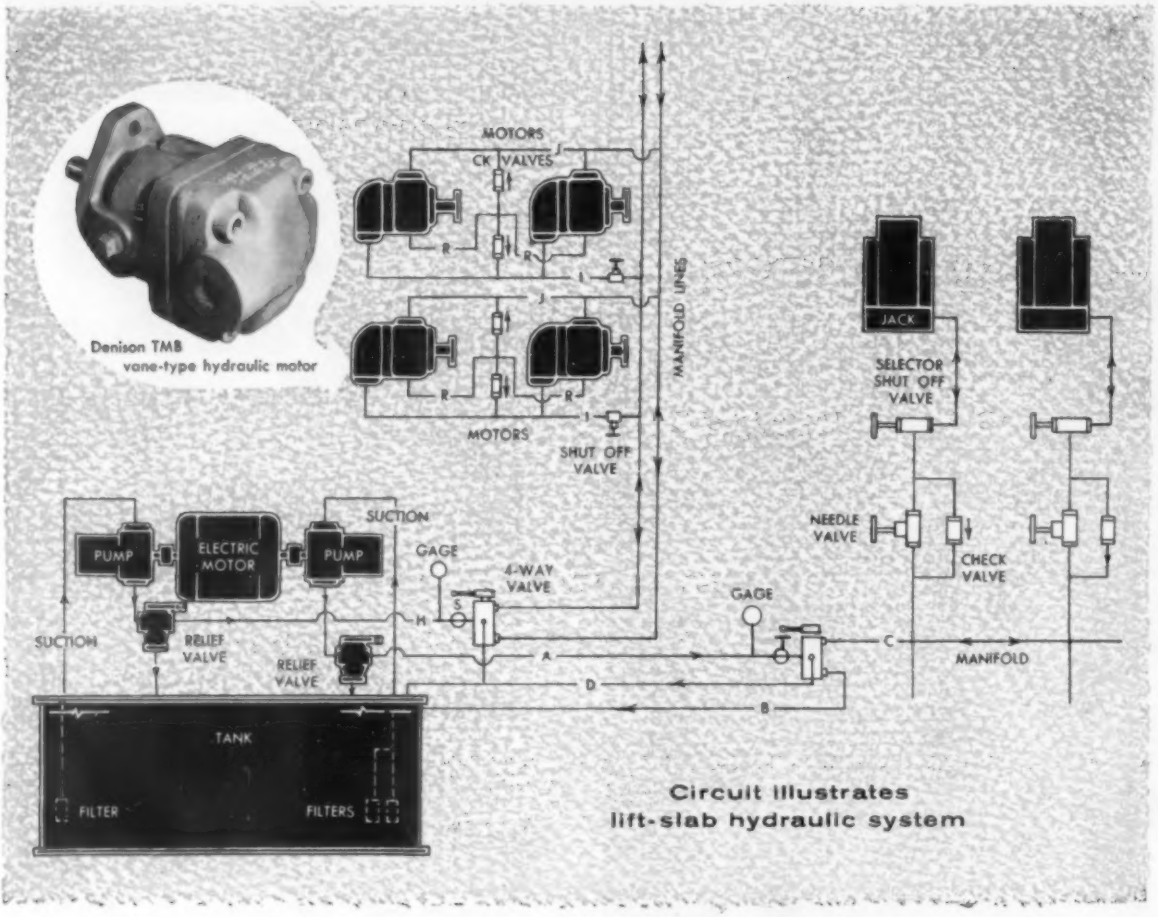
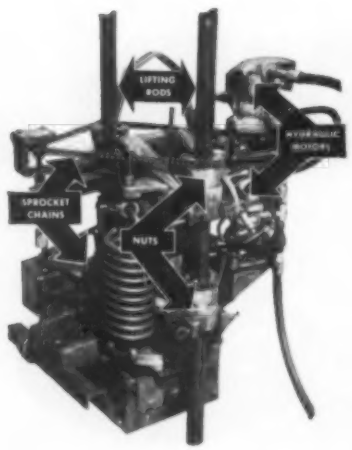


Helping to raise the roof

...another application for Denison hydraulic power



Lifting jack used in this operation can raise slabs 4 feet per hour. Nuts are turned by sprocket chains actuated by Denison hydraulic motors.

Since the first lift-slab building was erected in 1950, the interest and demand for this method of construction has increased to such an extent that lifting 500-ton slabs of concrete into the air hydraulically is now an everyday occurrence.

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Dependable, easily controlled hydraulic power assures a virtually foolproof operation.

This unique application illustrates one of many potential uses for hydraulic power. When designing any type of equipment or machinery, consult a hydraulic specialist. Write Denison Engineering Division, American Brake Shoe Co., 1166 Dublin Road, Columbus 16, Ohio.

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530-B

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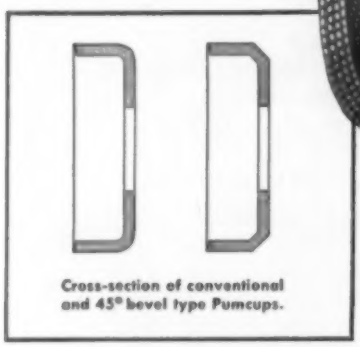

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Future Events

June 9-13: Semi-Annual Meeting, American Society of Mechanical Engineers, Sheraton-Palace Hotel, San Francisco.

June 9-14: Third Annual Automation Seminar, Pennsylvania State University, University Park, Pa. For complete information and registration contact Chester Linsky, assistant professor of industrial engineering.

June 12-14: Operations Research Conference, Illinois Institute of Technology, University Campus, Chicago. Additional information from Conference Coordinator, Illinois Institute of Technology, 3300 S. Federal St., Chicago 16, Ill.

June 24-28: Summer General Meeting, American Society of Electrical Engineers, Sheraton-Mt. Royal, Montreal, Quebec, Canada.

September 9-12: SAE Tractor Meeting and Production Forum, Hotel Schroeder, Milwaukee, Wis.

September 9-13: 12th Annual Instrument Automation Conference and Exhibit of The Instrument Society of America. Public Auditorium, Cleveland, Ohio.

October 1-5: SAE Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display, The Ambassador, Los Angeles, Calif.

October 17-18: The 13th Annual Conference on Industrial Hydraulics. Hotel Sherman, Chicago, Illinois. Raymond D. Meade is Conference Secretary.

October 23-25: Fall meeting National Fluid Power Association, Washington, D. C. For details write: Barrett Rogers, NFPA, 1618 Orrington Ave., Evanston, Illinois.

May 1-8, 1958: ASTE Tool Show, Convention Center, Philadelphia, Pa. For complete information write ASTE, 10700 Puritan Ave., Detroit 38, Mich. ▼▼▼

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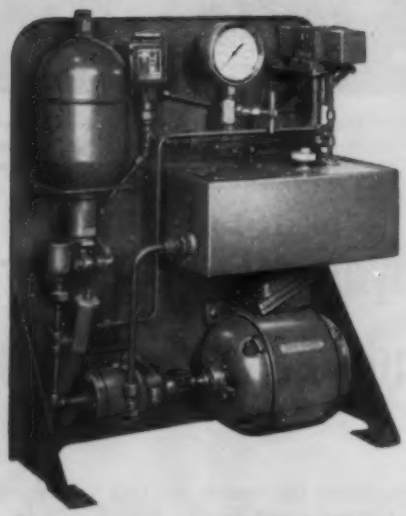

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AIR AND HYDRAULIC — VALVES, CYLINDERS, POWER UNITS

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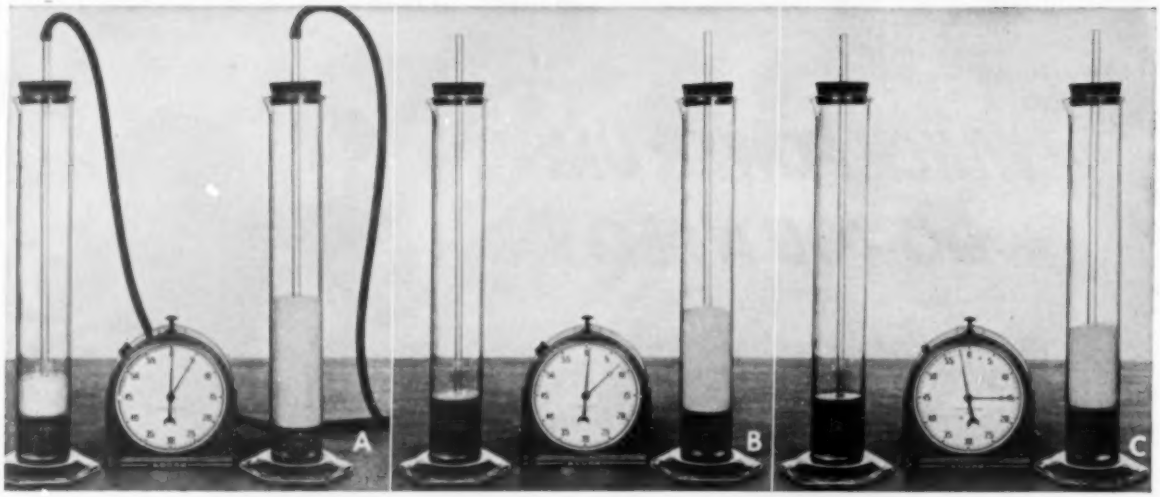

Under standard conditions air is bubbled for 5 minutes through *Texaco Regal Oil R&O* (left) and straight hydraulic oil, causing both to foam.

3 minutes later foam on inhibited *Regal Oil R&O* is almost gone. Finer bubbles on straight oil resist break-out, will entrain in hydraulic system.

Regal Oil R&O rids itself of foam in 10 minutes, straight oil takes 40. Coordinating Research Council Foam Test shows depressant's effectiveness.

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2. **A foam depressant protects your system when hard-to-detect air leaks develop in the suction line, through weak packing, an exposed inlet, etc.**

   Even though air is absorbed into a hydraulic system, it does not become a hazard until it bubbles out of solution, and is picked up in the system as foam.

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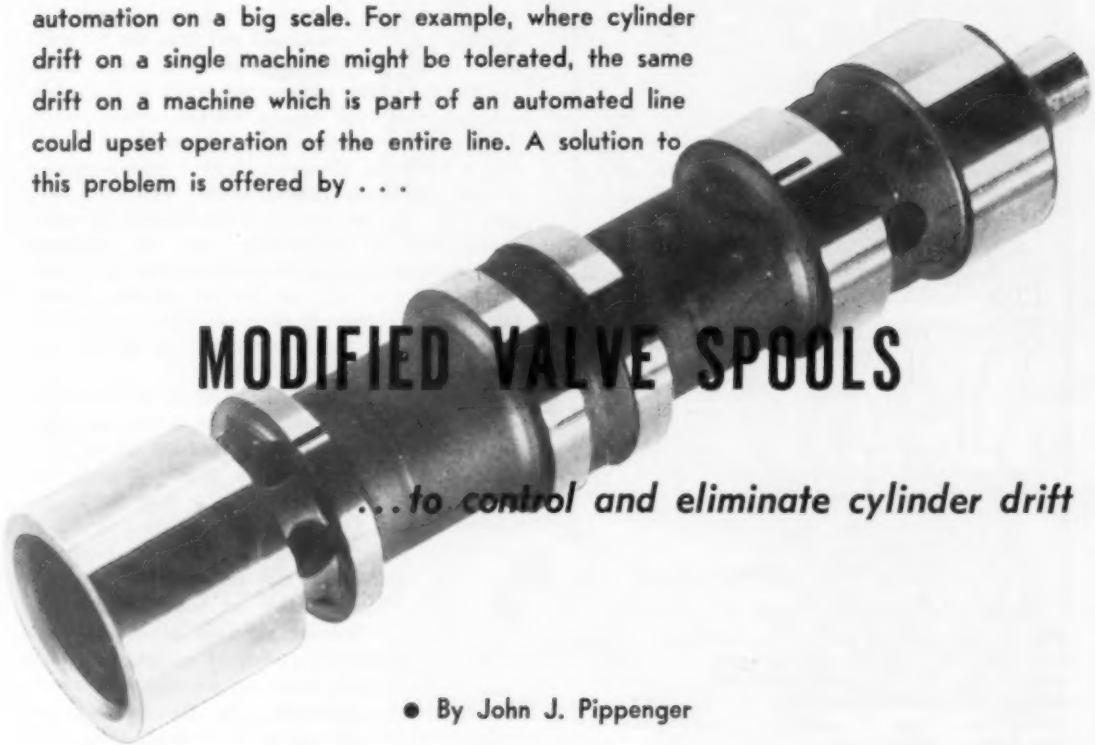
Hydraulic control problems have been magnified by automation on a big scale. For example, where cylinder drift on a single machine might be tolerated, the same drift on a machine which is part of an automated line could upset operation of the entire line. A solution to this problem is offered by . . .



MODIFIED VALVE SPOOLS

. . . to control and eliminate cylinder drift

• By John J. Pippenger

CYLINDER drift may occur with single-ended cylinders controlled by a three-position, four-way, spool-type valve. It may occur with both open and closed-center valves. In either case, the reason is because equal pressures are applied to both ends of the cylinder thus producing movement due to the differential in area between the rod and blind end of the cylinder.

CLOSED-CENTER VALVES

When a single-ended cylinder is supposedly held in a stopped position by a closed-center, four-way, spool-type valve, it will drift until the rod is fully extended or until movement is stopped in some other way. This drifting occurs because there is a small leakage or clearance flow in the spool-type, closed-center valve rather than a perfect leak-tight seal, Figure 1. The flow exists because of normal production fits and clearances necessary to compensate for thermal expansion of the valve parts. This flow allows pressure to be applied to both ends of the cylinder. The piston then drifts due to the area differential between blank and rod ends. The amount of drift which can be expected is a function of the forces involved. High operating pressures because of heavy loading will increase drift rate. Since clearances are constant, flow through them will be directly proportional to the

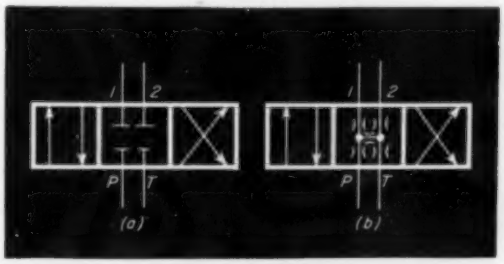


FIG. 1. ALTHOUGH ALL PORTS of a closed-center, four-way, spool-type valve, *a*, are supposedly closed when the valve is in the center position there is some leakage due to necessary spool clearance. A more accurate representation of this condition than the conventional JIC symbol would be as shown at *b*. Result of this restricted flow is a tendency for single-rod cylinders to drift.

JOHN J. PIPPENGER, *Double A Products Co., Manchester, Mich.*

MODIFIED VALVE SPOOLS

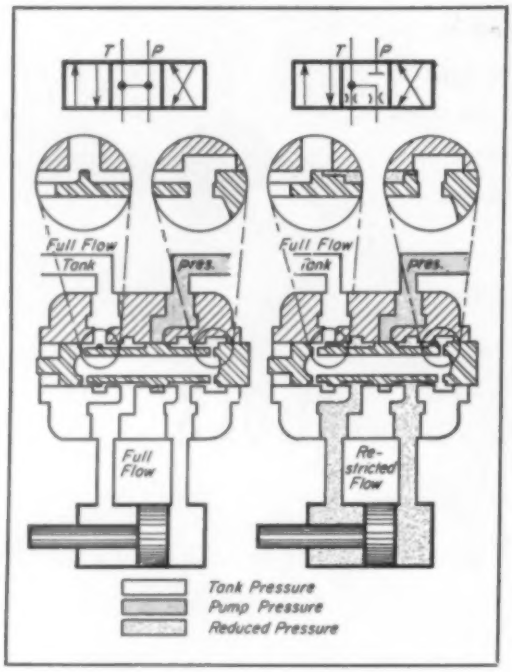


FIG. 2. CREEP CAN BE ELIMINATED by using a four-way valve with a modified spool. The spool is modified by the addition of small orifice slots which connect the cylinder ports to the tank port. An open-center valve, left, is compared with the modified closed-center valve, right.

pressure. Oil viscosity will also have an effect upon drift rate.

In many applications this drift may be of little consequence. If the machine is adequately counterbalanced, has relatively snug ways, and tight packing glands on the piston rod, pressure buildup may not be sufficient to cause cylinder movement. Differential area of piston and rod may not be sufficient in a particular application to cause movement. For reasons such as this, drift is limited in occurrence and the cure is not too well known.

Naturally, double-rod cylinders would not be subject to drifting. However, many machines cannot use fully balanced cylinders of this type. Economics also work against the use of double-rod cylinders.

Obviously, if the cylinder must be accurately positioned with respect to other moving parts of a machine, this drifting can not be tolerated. In certain machines, there is the possibility of actual interference with and subsequent damage to both machine parts and the product.

One answer to this problem is to hold pressure against the cylinder while in the stopped position. However, this means that the cylinder has to be at one end or the other of its stroke. In many instances, this increases total cycle time by an excessive amount. Of course, such a system is out of the question during jogging for set-up purposes, since jogging requires that the cylinder remain in any intermediate position at which it may be stopped. When holding pressure against the cylinder requires having a solenoid energized, an electrical failure might have dangerous consequences.

• **Modified Spool Designs**—To maintain the cylinder in a fixed position but still block the pres-

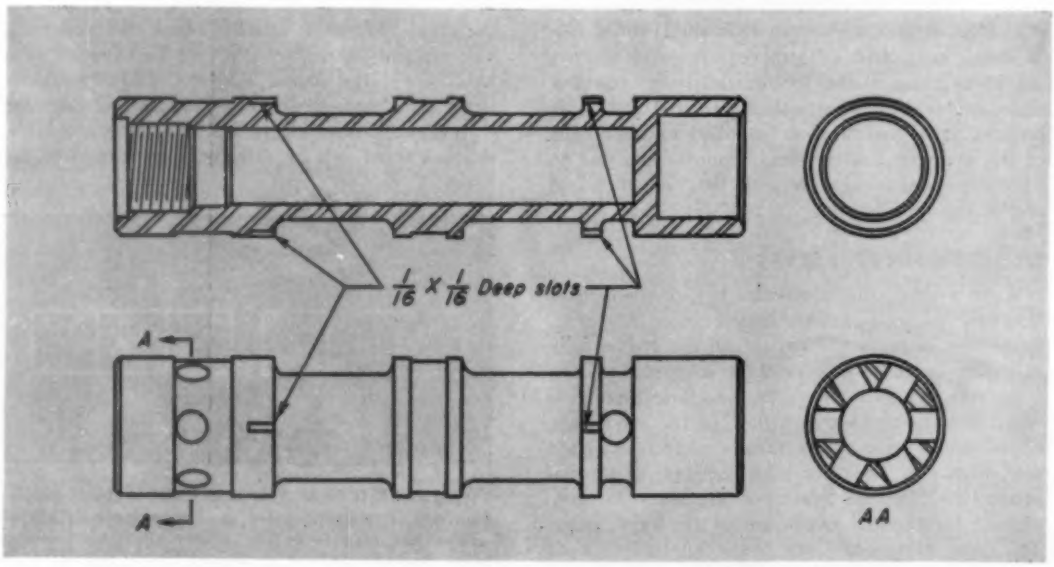
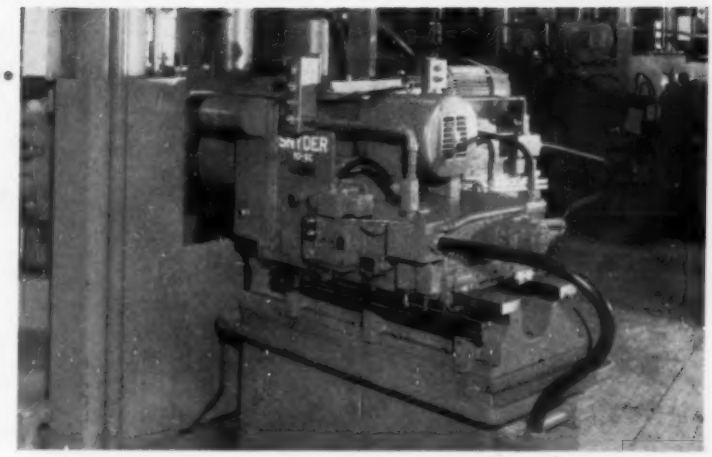
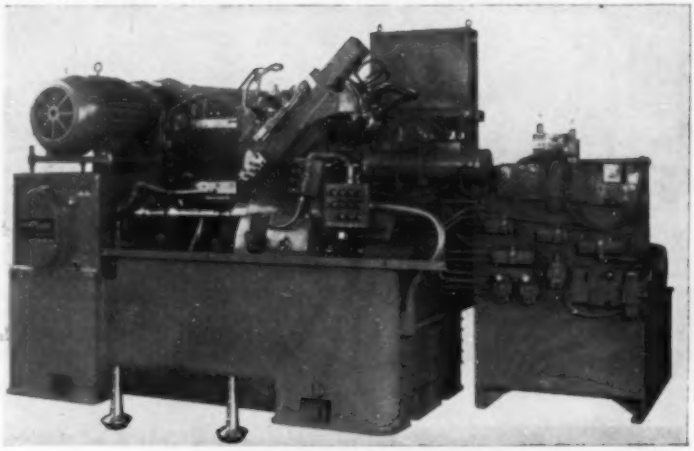


FIG. 3. DRAWING OF THE MODIFIED closed-center valve spool shows actual location of the orifice slots. Use of the small orifices results in retention of the positive deceleration feature of the closed-center valve while eliminating drift. Orifices also reduce shock when the spool is centered.



ON THIS AUTOMATIC machine cylinder drift cannot be tolerated. A modified spool in the feed control panel permits stopping tool travel at any point in the available piston stroke without the possibility of drifting.



THREE PANELS using modified valve spools to prevent cylinder creep are in the circuit of this automatic machine tool. Elimination of cylinder creep has become increasingly important because of the expanded use of such fully automatic machines.

sure port, there are three types of revised spools. The first of these blocks the pressure port as does the closed-center valve but connects the tank port to the cylinder ports through small fixed orifices, Figure 2. These orifices are small slots in the valve spool, Figure 3. Since both cylinder ports are connected to tank there is zero pressure on both ends of the cylinder and no movement can occur. Since connections to tank are through small orifices, the valve still provides deceleration of the cylinder and the locked-piston characteristic of the closed-center valve when the spool is shifted to the center position. An advantage obtained when this spool is moved to the center position is a noticeable decrease in shock because of the orifices.

The other two spool modifications are intended for applications where it may be an advantage to maintain a definite static pressure on one cylinder line or the other. When this condition exists, spools are available to provide a bleed path from one cylinder port or the other to tank, Figure 4, through a small orifice such as previously mentioned.

When any of these three spool types is to be used to control drift there are certain precautions which should be taken. Since one or both cylinder ports are connected to tank, a force on the cylinder can cause cylinder movement. Therefore, the cylinder must be in a horizontal position so that the force of gravity cannot cause it to move. Vibration in the vicinity of the cylinder might also cause it to drift.

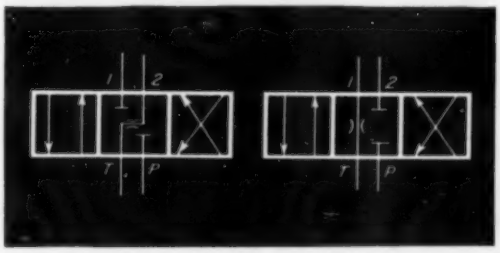


FIG. 4. For applications where a small static pressure in one cylinder line or the other may prevent drift, special spools to connect one cylinder port or the other to tank through a small orifice are available. Symbols show the location of the orifice in the circuit.

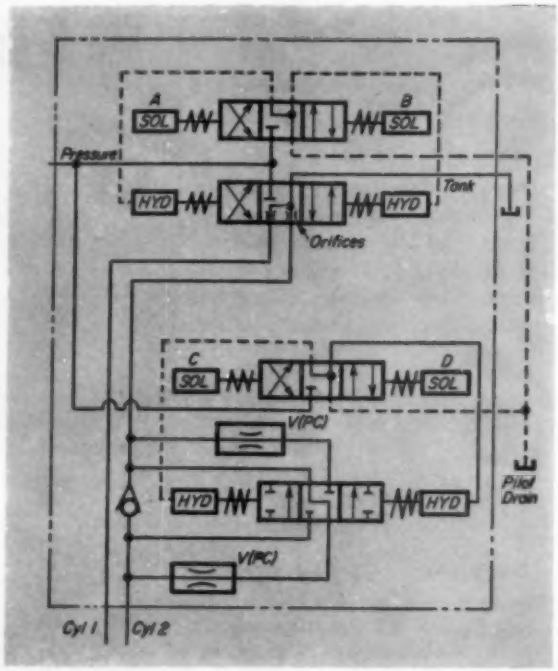


FIG. 5. MODIFIED CLOSED-CENTER VALVES have been successfully incorporated into feed panels providing rapid traverse forward, two adjustable forward feed rates, and rapid return. The panel shown photographically and diagrammatically is all-solenoid controlled. A variation of this is available with cam control of shifts to rapid traverse and controlled feed rates. In the panel shown here, rapid traverse forward is started when solenoids *A* and *C* are energized. The coarse feed cycle starts when solenoid *C* is de-energized and solenoid *A* alone is energized. Fine feed cycle is started when solenoids *A* and *D* are energized. When solenoid *B* is energized and solenoid *A* de-energized, there is a rapid return whether or not solenoids *C* and *D* are energized. All flow is blocked when solenoids *A* and *B* are de-energized. Solenoids are not of the momentary contact type and must be held energized.

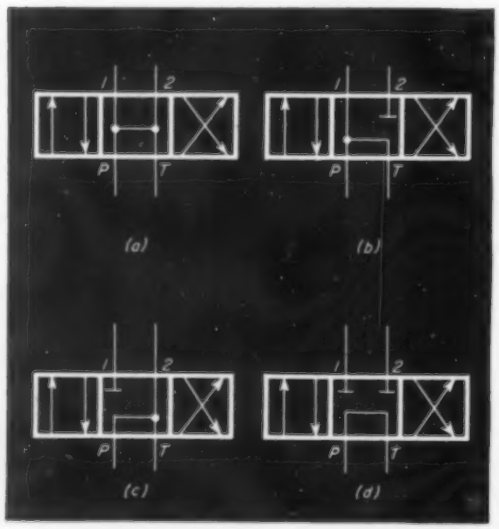


FIG. 6. CYLINDER DRIFT may occur with open-center, four-way valves of the type represented by symbol *a*. Valves having ports connected as indicated by symbols *b*, *c*, and *d* will minimize or prevent drift and still connect pressure port to tank when the valve is in the center position.

If these conditions exist, the cylinder must be adequately counter-balanced.

• **Availability**—In addition to being available as a single valve, the valve in which both cylinder ports are connected to tank in the center position is available as part of a complete dual feed panel, Figure 5. The panel provides rapid traverse forward, two adjustable feed rates, and rapid return.

Spools of the type having only one cylinder port connected to tank, Figure 4, are also used in similar multiple control panels. In such applications, the valves permit the cylinder to drift away from the work if there is any drift. During normal machine cycling, this would not be apparent. When the machine is started after a down period, the rapid traverse portion of the cycle quickly repositions the mechanism. The ability to control direction of drift in this way, can often be more desirable than using the valve with both cylinder ports connected to tank through orifices.

OPEN-CENTER VALVES

Another condition under which cylinder drift may be a problem occurs with the open-center spool, Figure 6a. In this case all ports are connected to-

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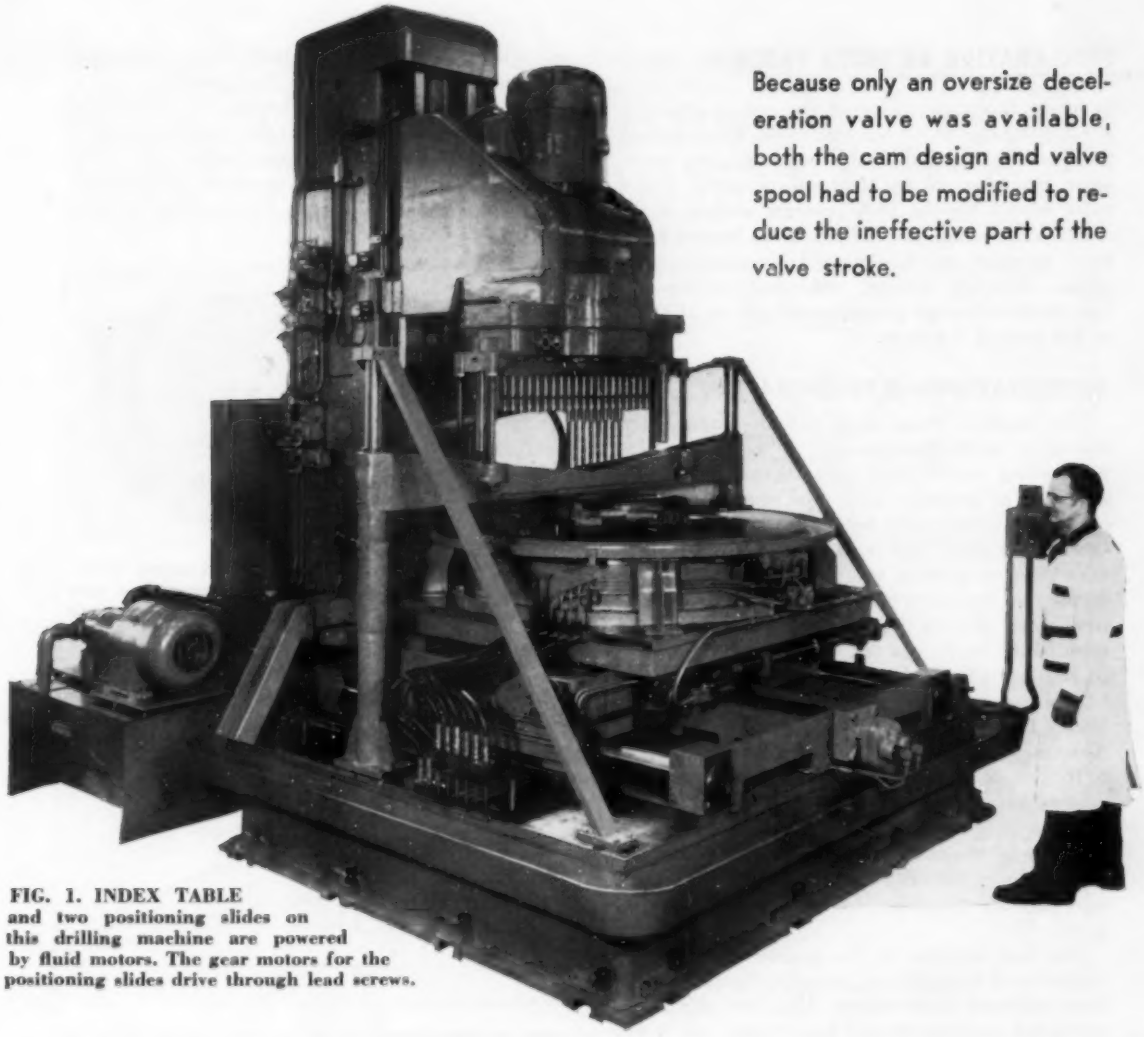

Because only an oversize deceleration valve was available, both the cam design and valve spool had to be modified to reduce the ineffective part of the valve stroke.

FIG. 1. INDEX TABLE and two positioning slides on this drilling machine are powered by fluid motors. The gear motors for the positioning slides drive through lead screws.

DECELERATING AN INDEX TABLE

...without shock

● By T. J. Becker

Chief Engineer, Michigan Drill Head Co., Detroit, Mich.

HIGH shock pressures can be the result of improper deceleration. At Michigan Drill Head Co., a large multiple drilling machine for boiler plates incorporates a 60-inch index table as well as positioning tables operating in both lateral directions. All three of these are driven by fluid motors. The index table is driven by a vane type motor with an output of 6.3 hp at 800 psi and 1800 rpm. The two positioning tables which slide at right angles to each other are driven by gear type motors.

Improper operation of the machine as it was originally designed led

to a very thorough testing of the system pressures at various stages in the machine cycle. These showed that just after the index table began slowing down, surge pressures up to 1800 psi occurred. Relief valve setting for the high pressure section of the combination pump was 750 psi. When heavier loads were mounted on the index table—larger work pieces, clamping devices, and other tooling—the tests indicated surge pressures as high as 3100 psi at this part of the cycle.

DECELERATION VALVE OPERATION

The cause of these surge pressures was determined to be in the operation of the deceleration valve which was actuated by cams mounted on the periphery of the index table. The smallest deceleration valve which could be obtained was rated for flows to 20 gpm. That is, it could pass 20 gpm in the wide open position and meter this down to zero as the cam was depressed. However, the vane type fluid motor driving the index table had a displacement of .94 cu. in. per rev. and required only 5 to 8 gpm during the high speed part of the table travel.

This meant that the deceleration valve was completely ineffective for the first part of its actuation. This ineffective action took place through about 5/16 inch of the valve spool travel. Because of the original design of the valve and the low flow rate, shock occurred at that point. Further actuation of the valve by the cam did meter the fluid motor output and bring the table to a stop, but there was no such smooth transition from high speed to low speed.

The first solution to the problem was the installation of accumulators as surge dampeners, and these achieved some success. However, this meant additional components and higher cost, and it was felt that the accumulators were more of a crutch than a real remedy. It was decided that the solution lay either in the cam shape or the valve spool design, and so both of these were investigated.

CAM REDESIGN

The original cam design, shown in Figure 3 had a constant drop of 3/64 inch/degree over a distance of 5½ inches. Consequently the cam closed the valve at a uniform rate, regardless of the fact that the valve was ineffective over much of its travel and had no control of the oil during that time. In redesigning the cam, the objective was to get this travel over with as quickly as possible and to use most of the cam for depressing the deceleration valve during the controlling part of its travel.

The redesigned cam, Figure 4 has a much steeper slope at the beginning and a much slower slope after that. The first 5/16-inch travel of the valve, during which there is no throttling, is now accomplished as the valve roller travels over only 30% of the cam. The remaining 70% of the cam now forces the valve spool through the last 3/16 inch which is effective in metering output from the fluid motor.

While this cam redesign helped in overcoming the shock problem, it was not the complete answer. The action of the table was improved considerably, and a smooth indexing was obtained, except when the table was heavily loaded. The next step was to

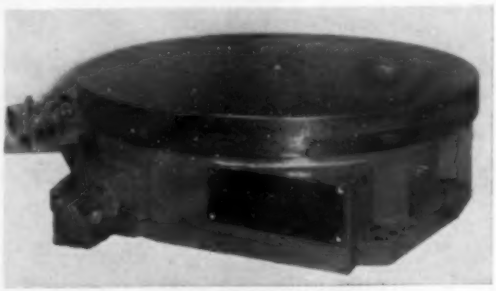

FIG. 2. INDEX TABLE shows fluid motor drive, deceleration valve, and redesigned cams. New cam design with modified valve spool now gives smooth operation even at high loading.

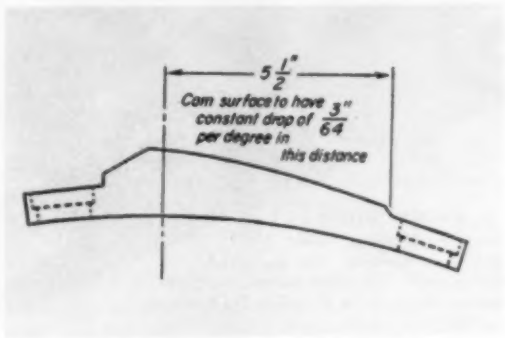

FIG. 3. ORIGINAL CAM had a constant drop of 3/64 inch/degree over the 5½-inch surface. The effective valve spool travel was limited to the very end of the cam surface.

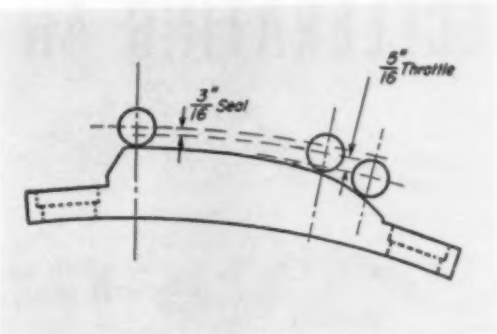

FIG. 4. REDESIGNED CAM is steep at the beginning and has a slow slope for the remainder of the surface. This limits the first 5/16 inch of ineffective valve spool travel to 30% of the cam surface. Remaining 70% produces 3/16-inch of effective travel.

alter the shape of the decelerating valve spool. Originally the valve spool had a taper on its land to slowly meter fluid flow as the spool was actuated. In place of this tapered spool a spool with a 1/16 x 45-degree chamfer was substituted. The new spool was machined with 60-degree axial grooves to provide the metering effect.

DRILL FEED

The drills are fed into the work by a cylinder, and two solenoid-controlled, pilot-operated valves are arranged with a flow control valve to sequence rapid advance, feed, and rapid reverse. This is shown in Figure 6. For rapid advance of the drill

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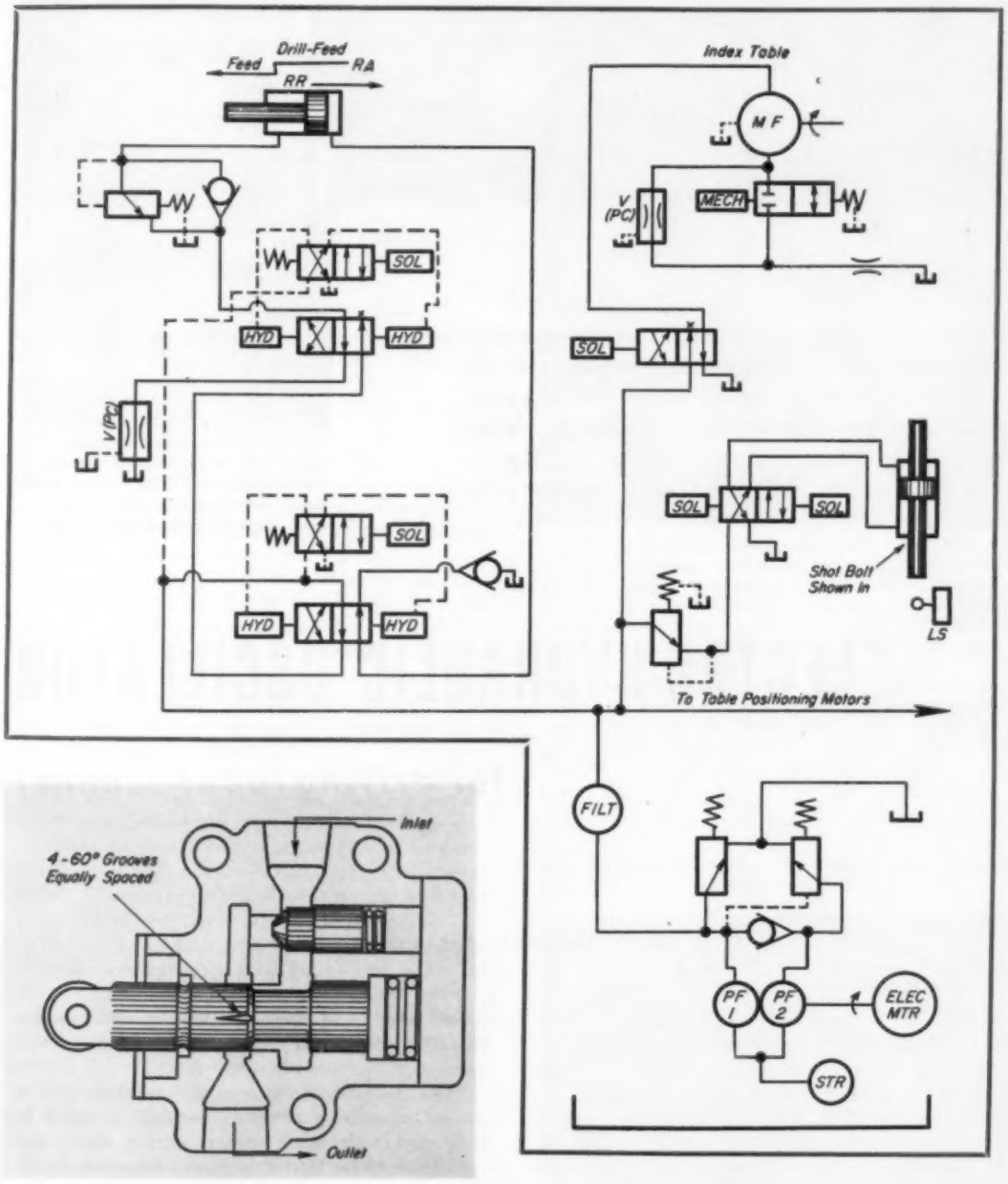
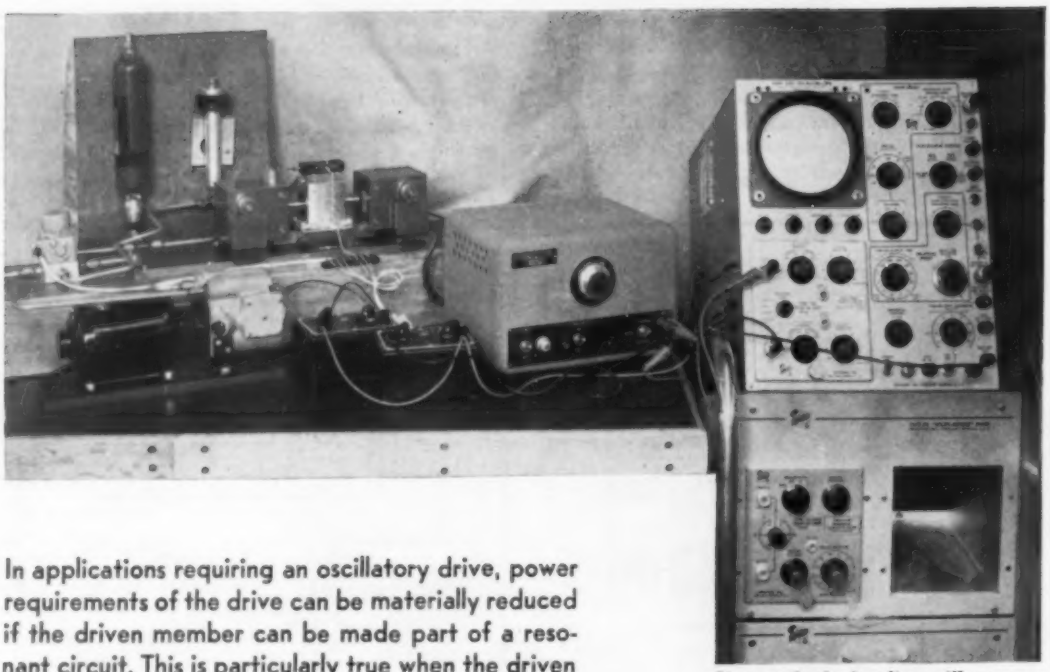


FIG. 5. MODIFIED VALVE SPOOL replaces the original metering taper with a chamfer and metering grooves. Valve is rated for 20 gpm and is required to meter only 5 to 6 gpm, but was the smallest unit available.

FIG. 6. CIRCUIT DIAGRAM shows arrangement of flow control valves metering index table drive motor output. During the maximum speed of the table, flow bypasses the pressure compensated flow control valve through the deceleration valve.



To test the hydraulic oscillator concept, this experimental oscillator was constructed. The system oscillated very nicely at 10 cps with a 1 in. peak-to-peak displacement.

In applications requiring an oscillatory drive, power requirements of the drive can be materially reduced if the driven member can be made part of a resonant circuit. This is particularly true when the driven member is a fairly heavy mass with resulting high inertia. Recognition of this fact led to the design of an . . .

ELECTRO-HYDRAULIC OSCILLATOR

. . . for driving radar scanner

• By Theodore J. Mapes

A RADAR scanner drive must impart an oscillatory motion to a fairly large mass, the scanning dish. In such a case, the forces to be overcome are friction losses in the mechanism (linkages, gear trains, etc.) and the acceleration forces required to reverse the direction of motion at the extreme limits of the oscillation. Generally, the acceleration forces will be much greater than those due to friction. Designing the drive to overcome the acceleration loads requires peak power much greater than the power required to overcome friction forces alone.

Since the load, in the case of a radar scanner is an energy storing element (inertia), it could be combined with other energy storing units with an inverse characteristic to form a resonant circuit. Then the drive would have to supply only the frictional losses to maintain oscillation. Savings in cost, size, weight and capacity of the drive would thus result. Therefore, the design of an electro-hydraulic drive for a radar scanner was undertaken.

THEODORE J. MAPES, *Project Engineer, Eastern Industries Inc., Hamden, Conn.*

• **Resonant Circuits**—When a resonant system, Figure 1, is subjected to a shock input, it will vibrate or oscillate at a frequency dependent upon the parameters of the energy storing elements forever if it were not for the friction losses in the system. Oscillation would be sinusoidal, Figure 2*a*. However, friction is present as mechanical friction in a mechanical system, as resistance in the electrical system and as both fluid and mechanical friction in the hydraulic system. Therefore, the amplitude of the output exponentially decreases to zero as the stored energy is gradually dissipated in overcoming the frictional losses, Figure 2*b*.

In order to maintain continued oscillation at constant amplitude, it is necessary to measure the output of the system and supply energy to the system of proper amplitude and phase to compensate for the frictional losses. This is commonly done in electronic circuits such as Figure 1*b* by connecting an amplifier between input and output terminals. The same approach may be used to maintain oscillation in the hydraulic circuit of Figure 1*c*.

• **Electro-Hydraulic Oscillator**—Complete circuit of an electro-hydraulic oscillator is shown in Figure 3. Both electric and hydraulic components are included in the circuit. Load displacement is detected by a linear potentiometer which delivers a voltage proportional to displacement to an electronic amplifier. The amplifier contains adjustments for gain and valve balance as well as the amplifying components. Output of the electronic amplifier drives the split coil of a servo valve.

The servo valve is of the type known as "two-stage, flapper-nozzle first stage." In the valve, the current from the amplifier is applied to an electromechanical transducer which deflects an armature. This armature might be compared to the needle on an automobile ammeter since magnitude and direction of movement of the armature are proportional to the magnitude and polarity of the applied current. Motion of the armature or flapper unbalances a four-arm hydraulic bridge consisting of two orifices and two nozzles. Differential pressure thus obtained is applied to a spring-loaded four-way valve spool which is an integral part of the servo valve. This spool directs flow from the hydraulic power supply to the remainder of the circuit.

Hydraulic power supply is a constant-pressure, variable-flow type. A gear pump and a spring-loaded relief valve provide the constant-pressure, variable-volume system. A 5 micron porous-bronze filter and a pressurized sump complete the power supply unit which is contained in a single housing.

• **Operation**—Assuming that the piston, Figure 3, is moving upward, oil is being forced from the upper side of the piston to the upper accumulator. The servo valve also directs oil to the same accumulator at the same time. Eventually a point is reached at which pressure in the accumulator acting against the piston exceeds the inertia of the load and accelerates the piston downward. At this

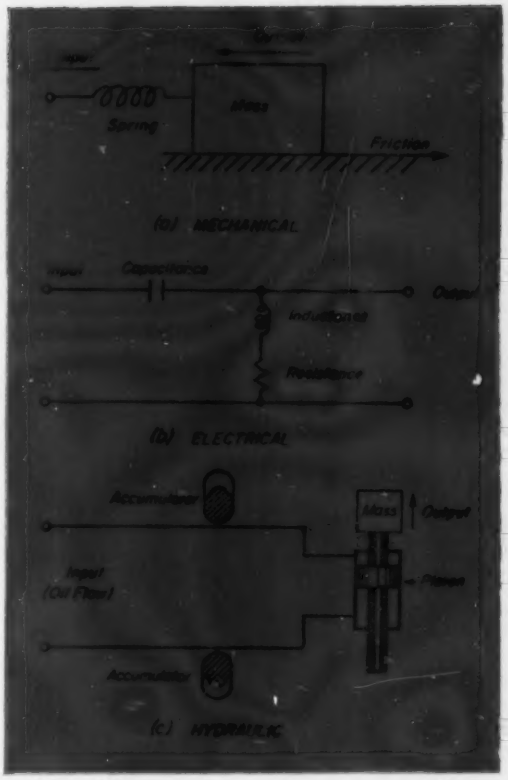
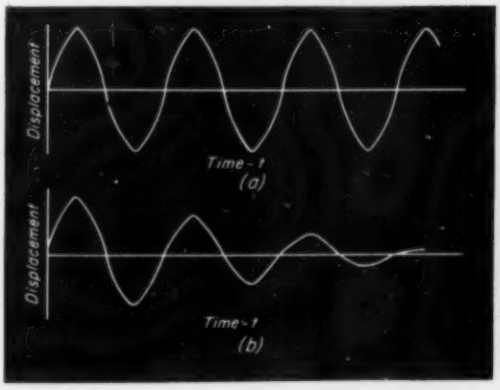


Fig. 1—If an input were momentarily applied to any of these systems and then removed, the systems would oscillate. Because the input energy would be alternately stored and then released by the circuit components. Since there are frictional or resistance losses in the systems, amplitude of oscillation decays to zero as the energy is dissipated. Continued oscillation can be maintained by connecting a source of energy to the input which will supply just enough energy to equal the losses. Of course, energy supplied in this fashion must be supplied at the correct time so as to be *in phase* with the oscillation.

Fig. 2—Oscillation in a resonant system with no losses, *a*, and in a system with losses, *b*.



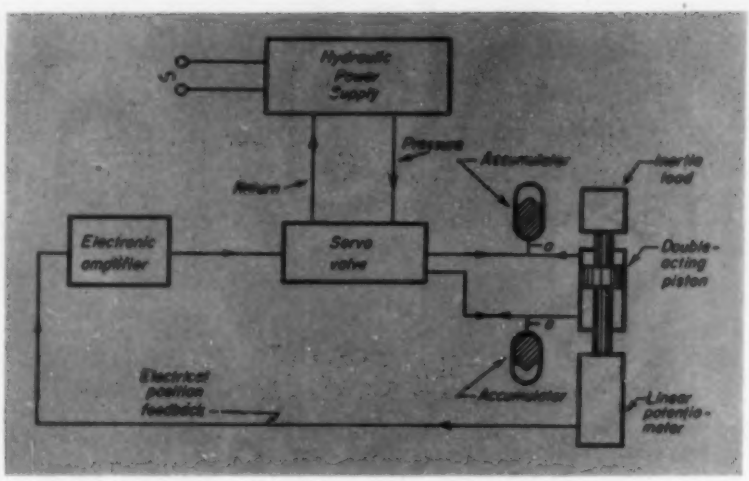


Fig. 3—Circuit diagram of the complete electro-hydraulic oscillator.

point in the operation the error signal to the valve is greatest and the valve is at its widest opening for that particular flow direction.

As the piston moves downward, it forces oil to the other accumulator and also decreases the error signal to the valve. At the midposition of the piston stroke, the valve also passes through a neutral position and then shifts in the other direction to direct flow to the same accumulator being charged by the piston movement. Again, a point is reached for this direction of motion where accumulator pressure exceeds inertia of the load and the stroke is reversed. It can be seen that much of the energy required is stored in the accumulators and that this system would continue to oscillate were it not for the losses. The amplifier, of course, feeds just enough energy into the system to overcome these losses.

• **Frequency Calculations**—Basic resonant frequency of this circuit is a function of the accumulators and the load. However, slight frequency adjustments may be made by varying amplifier gain or inserting energy storing networks in the electrical feedback path to control system phase shift.

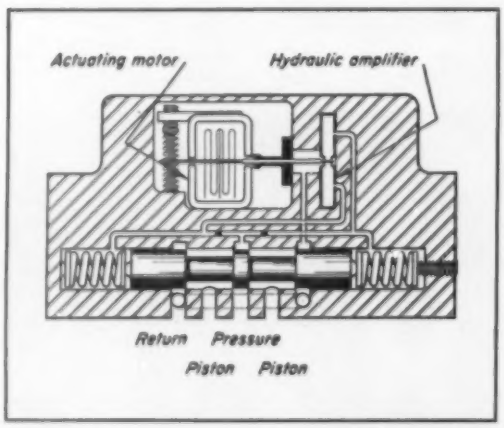


Fig. 4—Two stage servo valve controls oil flow to the oscillator circuit.

Courtesy Moog Valve Company

Fundamental resonant frequency for a circuit using spring-loaded piston accumulators may be calculated from

$$f = \frac{A_1}{2\pi A_a}\sqrt{\frac{K_a g}{W}}$$

where f = resonant frequency, cps; A_1 = differential area of load piston, sq in.; A_a = area of accumulator piston, sq in.; K_a = accumulator spring rate, lb per in.; W = load weight, lb; g = gravitational acceleration, 32 ft per sec^2.

In the case of accumulators where the spring action is supplied by compression of a gas, resonant frequency depends upon amount of precharge and the average oil level in the accumulator during system operation. Resonant frequency of a circuit using this type of accumulator may be calculated approximately from

$$F = \frac{A_1}{2\pi}\sqrt{\frac{g}{W}\left(\frac{\Delta P}{\Delta V}\right)}$$

where $\Delta P/\Delta V$ = the slope of the pressure-volume curve of the accumulator at the operating point.

• **Experimental Results**—An experimental oscillator constructed to test the concept of such a system oscillated very nicely at 10 cps. Peak flow from the hydraulic power supply was approximately 0.8 cu. in. per sec. Calculated maximum flow in the actuator for this frequency is 6.8 cu in. per sec. This is computed from

$$Q = A_1\ 2\pi F X_p$$

where Q = maximum flow in load actuator, cu in. per sec; A = area of load actuator, sq in.; f = frequency, cps, and X_p = peak displacement of actuator from neutral. Ratio of flow from the power

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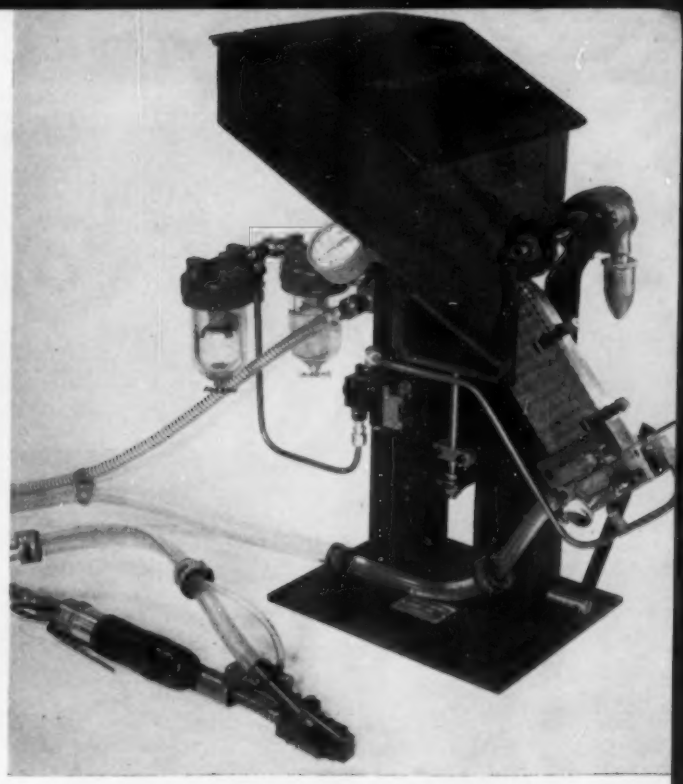
How would you automatically transport a screw from a fixed hopper to any point at any distance up to 20 feet from the hopper? An analysis led to the conclusion that the best way is by blowing them through a hose with compressed air. This conclusion was then translated into Pneuma-serve, a device using . . .



COMPRESSED AIR

. . . to feed screws automatically

SCREWS are automatically blown into driving position by an automatic feeding device which may be attached to nearly any air screwdriver. This makes it possible for an operator to drive screws just as fast as he can position the screwdriver plus actual driving time. No handling of the screws is necessary. Placement of the screwdriver automatically positions the screw and the screw is held firmly enough by the feeder jaws to allow it to be used as a drift for aligning holes in which the screw is to be driven.

• **Pneumatic Circuit**—Operating cycle starts with a screw in driving position when the driver bit is moved forward to driving position, Figure 2*a*. Motion of the driver and bit seats the cycle valve to apply pressure which was being bled off, to the

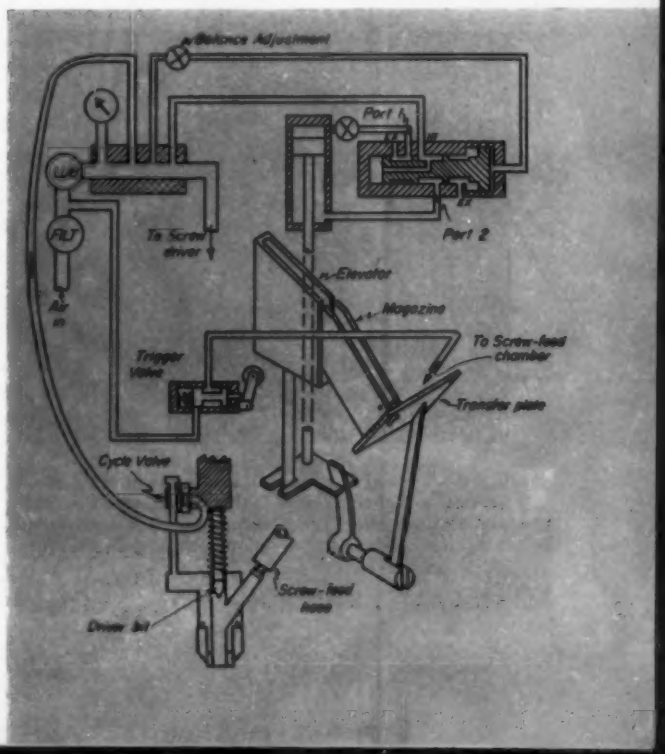


Fig. 1—Circuit diagram of the Pneuma-serve screw feeding device. Filter-lubricater removes contaminants and lubricates system to assure long, trouble-free service.

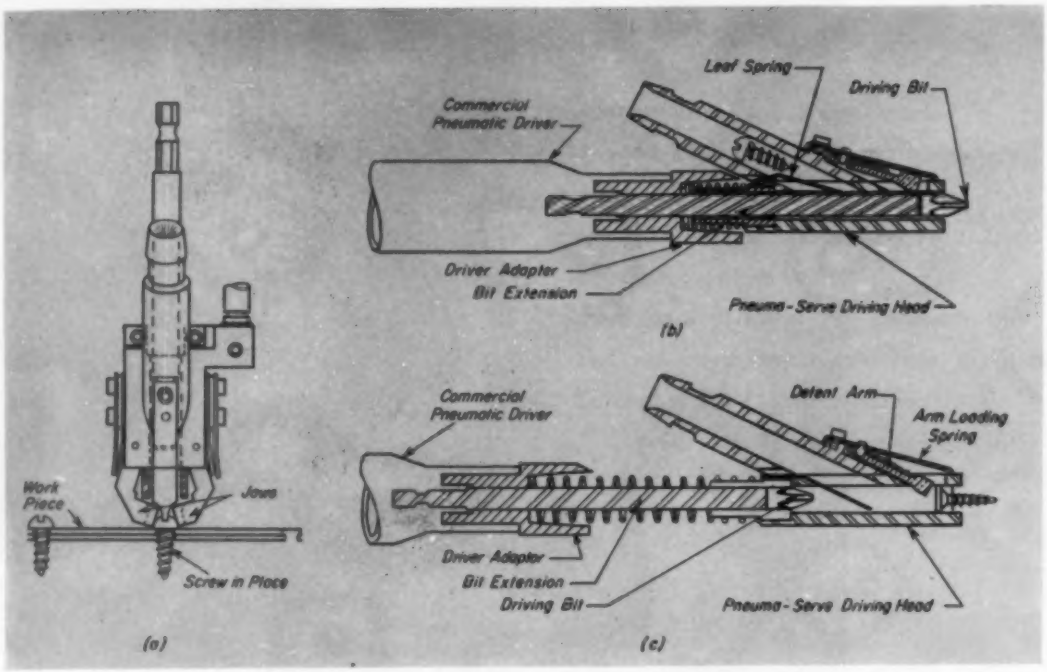


Fig. 2—Three views of the driving head. At *a*—the jaws, which grip the screw head from the sides, are shown holding the screw ready to drive. A side view at *b* with the driver bit extended shows how a spring leaf prevents a screw being blown through the hose from striking the revolving bit while a screw is being driven. When bit retracts, *c*, the screw held by the leaf spring is blown into holding position. The detent helps to hold screws firmly in place so the driver may be used in any position.

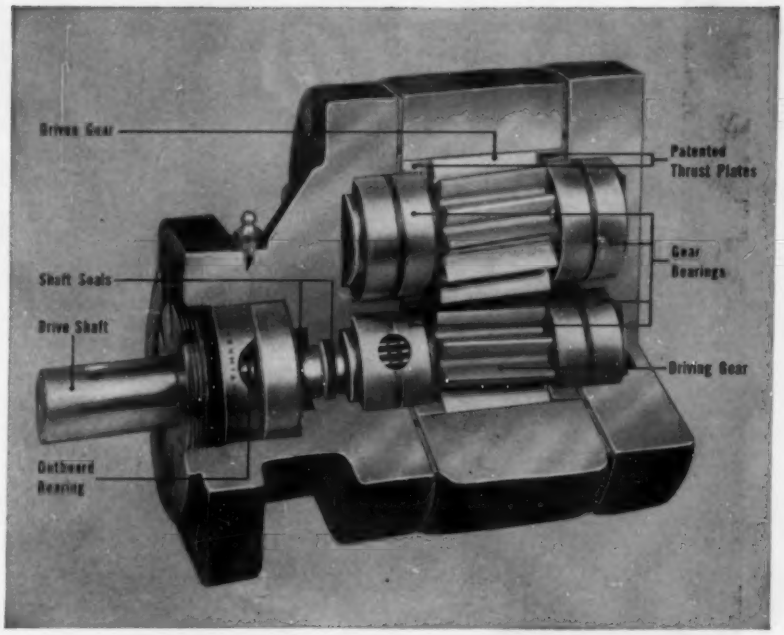
right end of the air-operated valve, Figure 1. Pressure against the end of the valve spool moves it to the left connecting inlet air to cylinder port 1 and exhausting cylinder port 2. The elevator actuating piston then moves downward. As the elevator moves downward, it actuates the trigger valve to supply air to the screw feed chamber and blow the screw which is in the chamber through a length of transparent plastic tubing to the holding head. Since the bit is in driving position, the screw goes only as far as the leaf spring in the head, Figure 2*b*.

Fig. 3—Typical of the applications in which Pneuma-Serve is a real time saver is this TV cabinet assembly job. Phillips sheet metal screws are being driven to hold the top shell closure. Two men now do the work of eight operators.

When driving is completed, removal of force by the operator allows a coil spring in the head to retract the bit. The screw is then blown into the holding position past the leaf spring and the detent arm, Figure 2*c*, where it is firmly held by the detent arm and spring-loaded jaws. Further retraction also unseats the cycle valve which bleeds pressure from the right end of the air-operated valve and allows pressure at the left end of the valve spool to force the spool to the right. Pressure is then applied to the lower end of the cylinder to move the piston upward. As piston and elevator move upward, the trigger valve is released and no more air is supplied to the feed chamber and tube.

• **Hopper Feed Mechanism**—From 5 to 8 hours supply of screws is contained in the hopper. As the elevator moves up and down in the hopper during the driving cycles it picks up screws, points down, in the slot in the elevator. These screws are then fed by gravity down the elevator and magazine. As the elevator moves downward it actuates a feed plate and feed-stop pin to hold back all but one screw while the feed plate moves the single screw to the right allowing it to fall into the feed chamber. ▼▼▼

ADVANCES IN HYDRAULIC PUMP DESIGN



Oil leakage controlled

In any method of mounting an oil-hydraulic pump there is always a certain amount of misalignment between the pump drive shaft and the shaft on the power source. Even where universal drives are utilized there is still the danger of a thrust load. Result in both cases: Flexing is transmitted into the pump seal and eventually to the bearings supporting the gear—leakage around the shaft is a sure-fire bet to follow.

At Commercial, by using an outboard bearing to protect the seals and internal bearings, the common leakage nuisance is eliminated.

Internal alignment perfected

Mass production of independent gear pump housing parts invariably results in varying degrees of internal misalignment—regardless of dowel pin control points used in machining. In many cases the "out" for the problem involves a loosening up on the internal tolerances —with a resultant loss in efficiency.

At Commercial, the patented thrust plate serves as a "natural" alignment control point—is counter bored on its face to match the bearing sleeve, then fits over the bearing sleeve and in turn pilots inside the gear housing. Perfect internal alignment—and increased efficiency—in any Commercial oil-hydraulic pump is axiomatic with rigid inspection of the thrust plate alone.

Constant volume assured

The principle of automatic adjustment of end clearance by internal pump pressure had one main weakness. The full pump pressure was applied against the whole area of each thrust plate. The plates would wear unevenly because on the inlet side of the pump the plate had full pump pressure on one face and a vacuum on the gear side.

By "pressure pocketing" Commercial insured that the pressures on opposite faces of the thrust plates would be in approximate balance around the entire area of the plate faces. Commercial's "one-two" advance design punch—the patented "pressure pocketed" thrust plate—assures constant volume at any pressure and at the same time helps to maintain simplicity of design and soundness of construction . . . provides for longer operating life and no maintenance headaches.

Seizing eliminated

Commercial oil-hydraulic pumps cannot seize because of heat induced by high speed or even inadequately piped systems. Variable end clearance and positive internal alignment make seizing practically impossible. Bearings evenly loaded throughout their length—no corner loading or spawling —are able to withstand much higher operating pressures. They stay in service longer too—regardless of pressures involved.

To take full advantage of tight internal tolerances Commercial designs, produces and grinds its own rotating gears—is able to hold extra close tolerances on tooth contours, outside diameters, and concentricity.

Over 5,000 different pump combinations—port locations and sizes—can be built from Commercial's standard line of oil-hydraulic pump components. A wide variety of drive shafts and mounting combinations are available to solve virtually any individual installation, piping and power application requirement.

Engineering help available

Commercial's oil-hydraulic pump engineering advances are typical of its complete line of oil-hydraulic equipment. The solid technical help Commercial sales engineers can contribute on the application of oil-hydraulic pumps, motors, cylinders and valves may be able to help cut your costs and improve performance.

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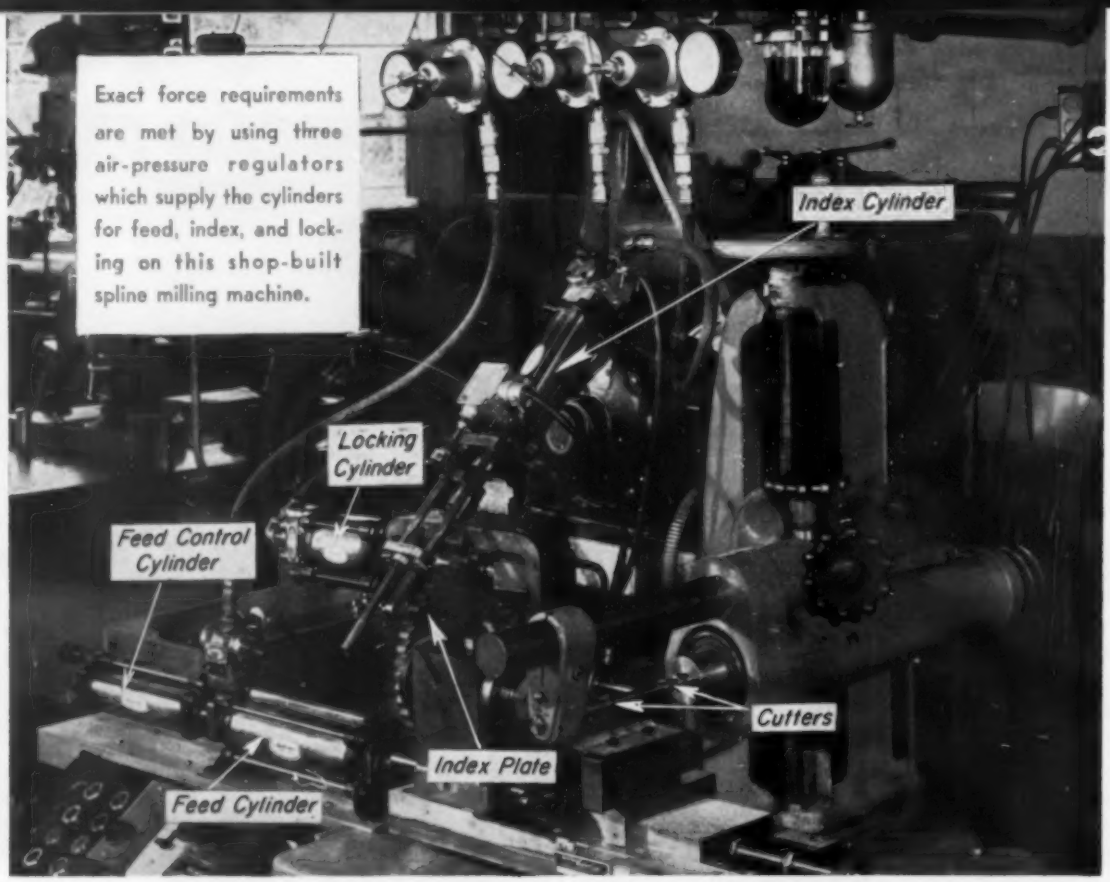
Exact force requirements are met by using three air-pressure regulators which supply the cylinders for feed, index, and locking on this shop-built spline milling machine.
Index Cylinder
Locking Cylinder
Feed Control Cylinder
Cutters
Index Plate
Feed Cylinder

AIR CYLINDERS have been mounted on an old grinder frame to make a special machine for precision milling. Production has been increased from 20 pieces per hour by hand operation 120 pieces per hour with air operation.

3 AIR REGULATORS

...serve separate cylinders on milling machine

• By S. H. White

OBTAINING proper force with a standard size cylinder is a matter of pressure regulation. Because the forces of the three cylinders used in building a precision splining machine were all different, three individual regulators were manifolded to the air line and supplied through a filter and lubricator.

The machine has been designed to mill splines on tips for gas torches. These splines are .010-inch wide, and from 10 to 60 splines are cut on the tip. These must be held to very close tolerances for proper operation in burning gas, and the base circumference of the splines must be held to within .0005 inch.

After the operator has placed two blank tips in the chucks of the machine, the sequence begins when a pushbutton is actuated. The locking cylinder advances the shot pin to lock the index plate in place, and this actuates a limit switch to extend the slide cylinder. At the end of the work stroke, a limit switch is actuated to retract the slide cylinder. When the cylinder has fully retracted, a limit switch is actuated to retract the shot pin. Limit switches then actuate a third cylinder to index to the next cutting position, and the cycle is repeated. This continues automatically until a button on the indexing plate actuates a normally closed limit switch stopping the operation.

An oil cylinder mounted in tandem with the air-feed cylinder controls the work feed rate by metering oil from one side of its piston to the other. All cylinders are controlled by integral 4-way valves which are solenoid controlled and pilot operated. ▼▼▼

S. H. WHITE, *President, Acetogen Gas Co., Detroit, Mich.*

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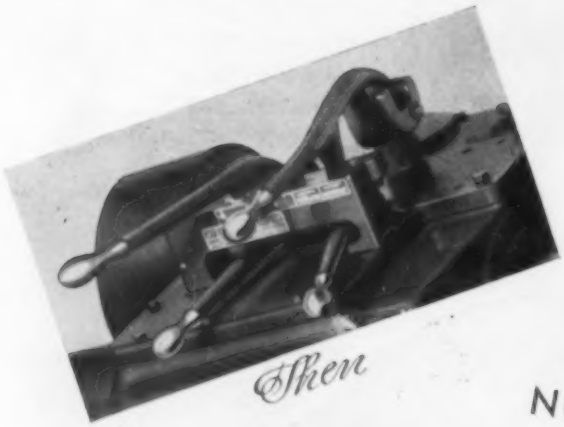

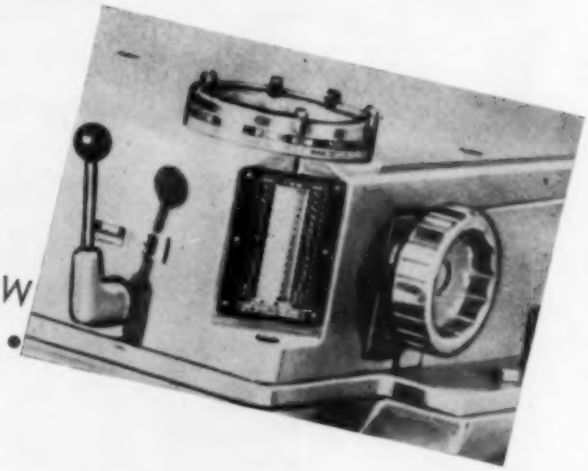

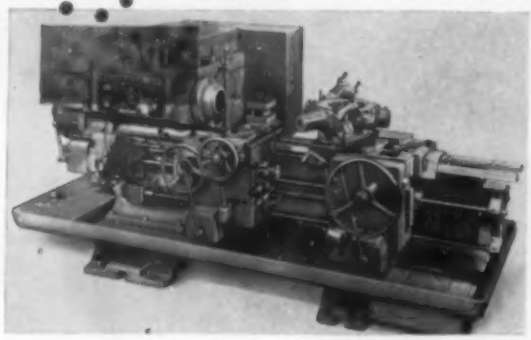

Normal evolution combined with hydraulics and an ingenious preselector mechanism for controlling four valves with a single, easy-to-operate knob have made possible the elimination of four large levers and an instruction plate.

PRESELECTOR MECHANISM

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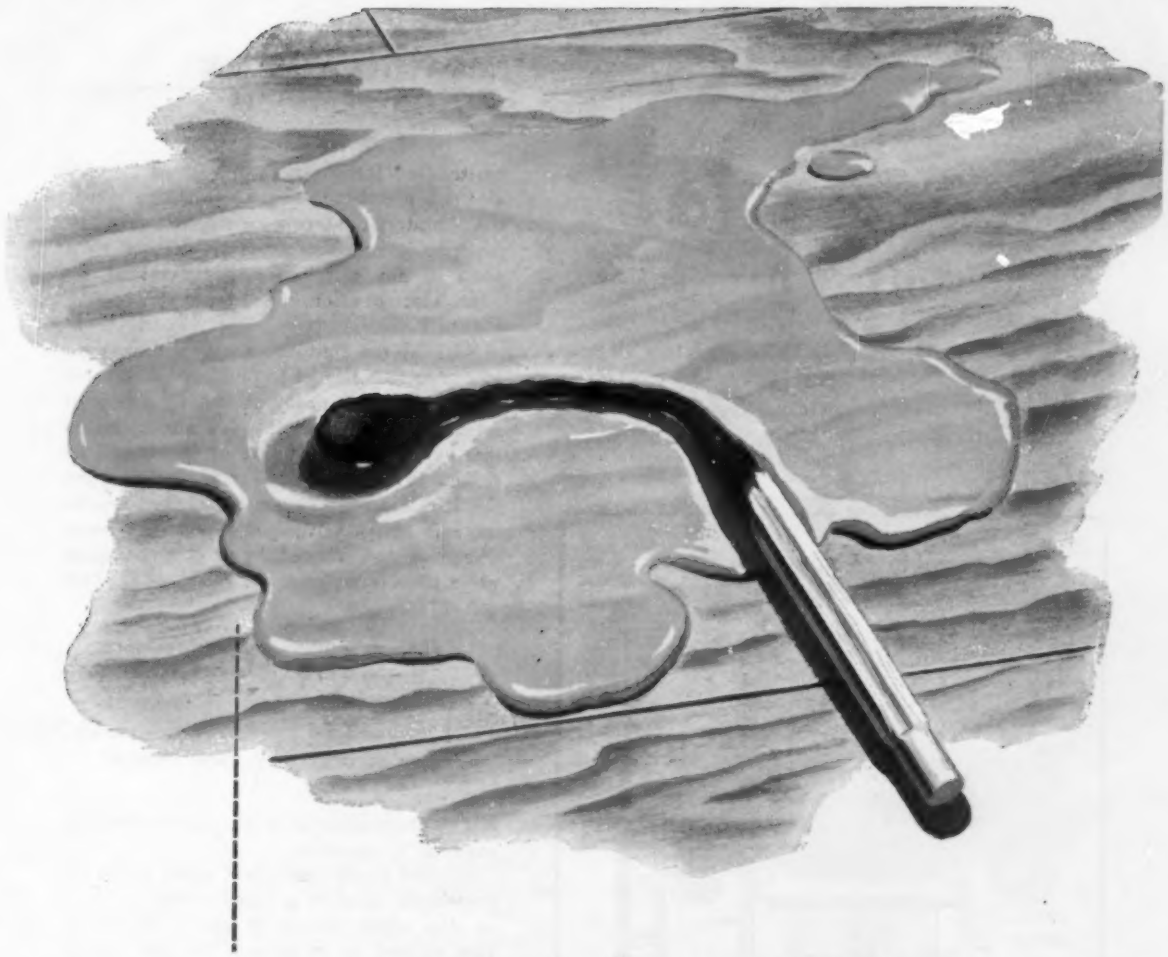
The speed clutches are controlled by four valve spools contained in a common valve body. An



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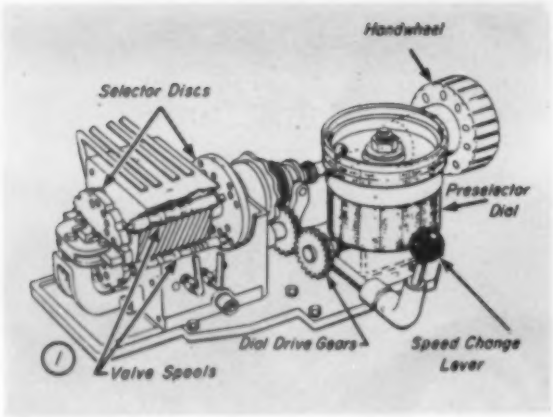
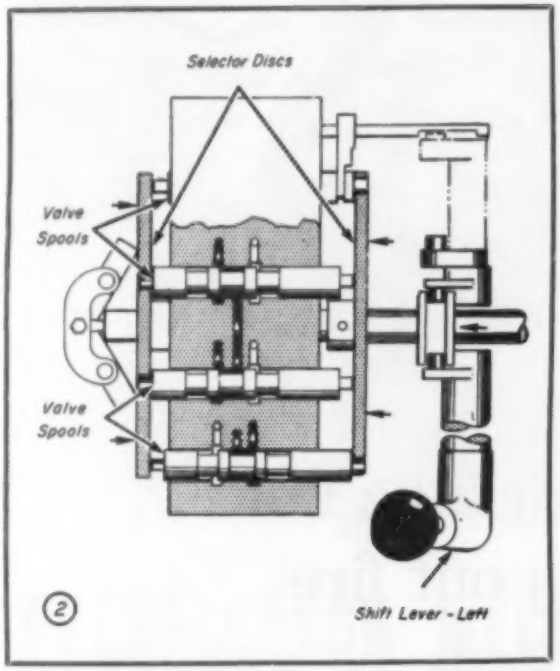
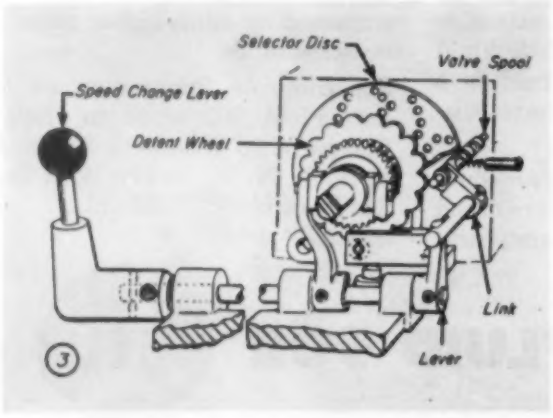
PRESELECTOR MECHANISM







outstanding feature of the design is the single-knob preselector mechanism which allows the operator to select a new speed while the machine is running, without reference to a chart or any sort of instructions as to the appropriate position of the four valve spools, Figure 1.

Each of the four valve spools directs oil to one or the other of two clutches. The valve spools are mechanically shifted by a pair of selector discs, Figure 2, which are drilled so that a certain combination of spools will be shifted in one direction or the other when the discs are forced against the extensions on the ends of the valve spools by a shift lever. The discs are rotated by a common shaft while disengaged from the valve spools. This allows preselection of a new speed while the machine is operating.

Human engineering plays an important part in the design of machine controls. Reduced operator fatigue and operator acceptance are measures of good design.

Coupled to the handwheel which drives the preselector discs is a speed-indicating drum or dial which shows the speed selected in rpm as well as in surface feet per minute corresponding to a number of diameters. A detent mechanism Figure 3, makes it necessay for the operator to position the selector handwheel and discs in one of 16 discrete positions corresponding to the available speeds.

Actual shifting to the preselected speed is done by moving a shift lever to engage the selector discs with the valve spools. The shift lever also is connected through a separate linkage to one of the valve spools which directs pressure to a pair of clutches for a "high-low" speed change. ▼▼▼

Fig. 1—Four valve spools are simultaneously shifted to preselected positions by moving the speed-change lever.

Fig. 2—When the speed-change lever is moved to the left, the selector discs are forced against the extensions at the ends of the valve spools.

Fig. 3—A detent wheel in the selector mechanism assures that the discs will be rotated to one of 16 discrete positions.

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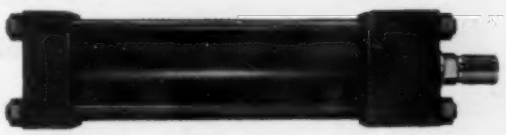

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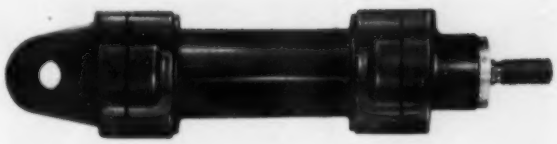

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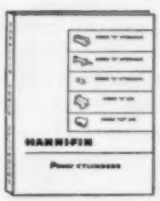
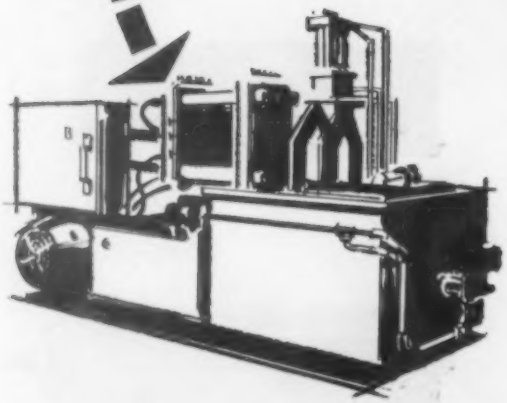


Critical aircraft specs

can often be relaxed

for industrial applications



HOW TO DESIGN FOR O-RING SEALS

. . . on air and oil-powered equipment

• By E. J. Parker

Last month, the first article in this series of three described how O-rings operate to seal fluid systems. Advantages, limitations and applications were discussed. This second article provides details of gland design to assure proper sealing action on specific jobs. Materials will be the subject of the final article in this series, next month.

PRACTICALLY all published data on O-rings follows accepted aircraft standards based on satisfactory sealing at —65°F and using breathing cylinders. Resulting dimensions and tolerances are safe, but impose cost penalties on equipment without these same operational requirements.

• **Dynamic seal**—For example, accepted standards call out dynamic seal gland width tolerances of +.000/-.001 for all O-ring cross-section diameters from .070 to .275. This tolerance requires extremely accurate machining, particularly in large diameters. A more realistic approach is a tolerance of ±.001 for the .070 cross-section and graduating upwards to +.001/-.004 for the .275 cross-section diameter. In industrial use these relaxed tolerances will prove satisfactory for practically all applications and the cost savings can be considerable.

• **Static seal**—Similarly, recommended practice dictates a static seal gland width tolerance of +.000/-.005. While this is satisfactory for an .070

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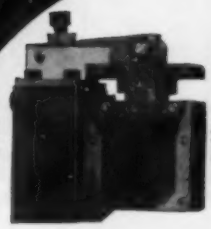

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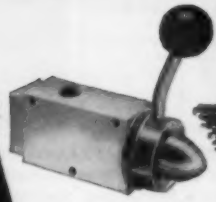

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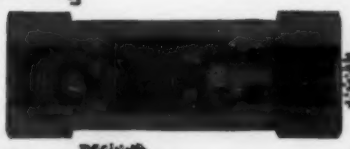

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250-500	.008	.010	.010
500-1000	.005	.008	.010
1000-1500	.003	.005	.008
1500-2000	—	.004	.005
2000-3000	—	.003	.004
3000-5000	—	—	.003

FIG. 1. ALLOWABLE CLEARANCE GAP beyond which extrusion will occur.

cross-section, it can in most cases be graduated upward to +.000/-.010 for the .275 cross-section diameter. This is particularly true of face type axial squeeze grooves, where adequate rigidity for pulling the mating surfaces metal-to-metal is available. Decreasing the static gland width to the low side of these tolerances may cause assembly difficulties in radial squeeze installations. This can be solved by a longer taper at the O-ring entrance, or by use of 50 or 60 Durometer O-rings where pressures are 500 psi or lower. These relaxed tolerances apply to the various gland designs illustrated in this article.

• **Minus tolerances**—Gland width tolerances given are predominantly minus, which means the high side of the gland tolerance represents average minimum safe cross-section squeeze, with the low tolerance increasing this squeeze. For some applications, such as double-acting pistons where slight internal leakage is not harmful, or valves where momentary leakage at reversal can be tolerated, the cross-sectional squeeze may be reduced somewhat, with a decrease in frictional resistance at pressures up to 250 psi. But, the amount of safe decrease in squeeze usually must be determined empirically for a specific situation. For higher pressures, a gland design for reducing friction is illustrated.

• **Surface finish**—In many cases it is possible to relax the surface finish requirements. However, the problem is complicated by wear and friction, in addition to sealing. In static sealing, where pressure pulsations are not violent, the usual recommendation of 32 micro inches RMS for the bottom of the groove and the mating surface may safely be revised to 64 micro inches. Where extreme pulsation is present it is best to adhere to the 32 micro inch value, even though the groove is designed to limit O-ring motion as much as possible.

• **Wear rate**—The wear rate of the O-ring and its mating surface will increase with surface roughness in dynamic sealing applications. Also, the amount of frictional resistance will rise. Hence the problem becomes one of required life and allowable friction. For many applications, where pressures are not excessive (50-500 psi), motion is not rapid and total required life cycles are low, a rubbing surface finish of 32 micro inches and bottom groove surface of 65 micro inches might prove entirely satisfactory. However, if low friction and long life are required, the usual recommendation of 32 micro inches for the groove bottom and 16 micro inches or better for the rubbing surface will produce better results.

• **Clearance gap**—Because of its effect on maintenance of equivalent squeeze, concentricity, and extrusion, the amount of allowable clearance gap is an integral factor of gland design. Primary criterion for allowable clearance is the dimension beyond which extrusion of the O-ring will take place.

Cross Section	"C" Dim.	"D" Dim.	"R" Rad.
.070	.055/.057	3/32	.02
.103	.089/.091	9/64	.02
.139	.121/.124	3/16	.03
.210	.185/.189	9/32	.05
.275	.236/.241	3/8	.06

FIG. 2. NORMAL GLAND DESIGN for reciprocating seals without anti-extrusion rings. D and R dimensions are not critical.

Cross Section	"D" Dim.		"C" Dim.	"R" Rad.
	Swell	No Swell		
.070	.091	.083	.065 / .057	.02
.103	.128	.116	.089 / .091	.02
.139	.171	.155	.122 / .125	.03
.210	.255	.232	.187 / .191	.05
.275	.341	.310	.239 / .244	.06

FIG. 5. ROTARY SEALS require careful diameter and material selection. Shaft surface finish in the rubbing contact area, and groove length, are critical.

Cross Section	"C" Dim.	"D" Dim.	"R" Rad.
.070	.047/.052	3/32	1/32
.103	.077/.083	1/8	3/64
.139	.106/.113	5/32	1/16
.210	.165/173	7/32	3/32
.275	.210/.220	5/16	1/8

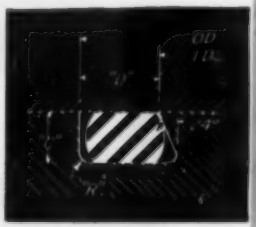

FIG. 8. LIGHT STRETCH FIT over an undercut sidewall simplifies assembly where static O-ring cannot be installed in a horizontal position.

Cross Section	"D" Dim.		"C" Dim.	"R" Rad.
	1 Backup	2 Backups		
.070	.138	.196	.005 / .007	.02
.103	.171	.229	.089 / .091	.02
.139	.209	.267	.121 / .124	.03
.210	.299	.371	.185 / .189	.05
.275	.407	.510	.236 / .241	.06

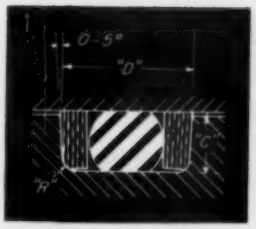

FIG. 3. GLAND DESIGN for reciprocating seals with anti-extrusion rings. D dimension is more critical, and is based on standard leather or Teflon backup rings.

Cross Section	"C" Dim.	"D" Dim.	"R" Rad.	"d" Dia.
.070	.055 / .057	.082	.017	1/64
.103	.089 / .091	.120	.025	1/64
.139	.121 / .124	.157	.035	1/32
.210	.185 / .189	.237	.052	1/32
.275	.236 / .241	.325	.068	3/64

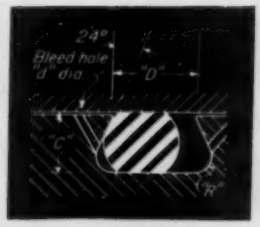

FIG. 4. UNDERCUT GROOVE, reduces running friction. R dimension is more critical, and downstream drain ports are advisable.

Cross Section	"C" Dim.	"D" Dim.	"R" Rad.
.070	.047/.052	.09	.02
.103	.077/.083	.14	.02
.139	.106/.113	.19	.03
.210	.165/.173	.28	.05
.275	.210/.220	.38	.06

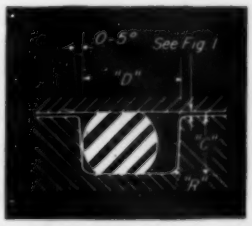

FIG. 6. STATIC GLAND DESIGN with D dimension not critical under steady pressure conditions. Where pulsation is present, D should equal installed cross-section length of the O-ring.

Cross Section	"C" Dim.	"D" Dim.	"R" Rad
.070	.047/.052	.15	.02
.103	.077/.083	.18	.02
.139	.106/.113	.22	.03
.210	.165/.173	.32	.05
.275	.210/.220	.43	.06

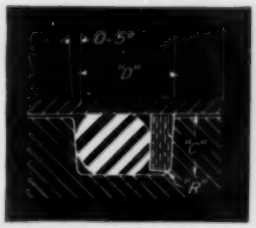

FIG. 7. ANTI-EXTRUSION RINGS are used where pulsations are heavy or frequency is high. This is the usual design where clearance gap exceeds the values in Figure 1.

Cross Section	"C" Dim.	"D" Dim.	"R" Rad.
.070	.047/.052	.062	.005
.103	.077/.083	.090	.010
.139	.106/.113	.119	.010
.210	.165/.173	.173	.015
.275	.210/.220	.231	.015

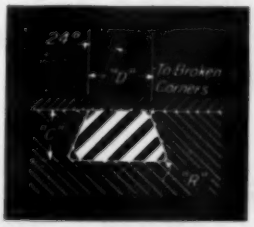

FIG. 9. FOR POSITIVE RETENTION a groove with both sidewalls undercut can be used. R dimension must be kept small to provide enough gland volume.

Cross Section	"D" Dim.	"R" Rad.
.070	.143	.017
.103	.205	.025
.139	.281	.035
.210	.425	.052
.275	.550	.068

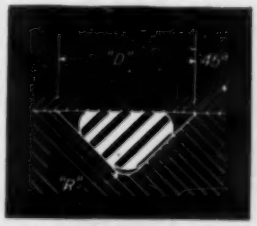

FIG. 10. VEE-GLAND permits a higher pressure-clearance gap combination for non-pulsating static seals than given in Figure 1. Due to wear factors, this design is not suitable for dynamic or pulsating pressure static seals.

Figure 1 lists these dimensions as functions of O-ring Durometer and system pressure.

• **Extrusion protection**—When the clearance gap must exceed the critical value, some form of extrusion protection must be provided. In non-pulsating static use, an increase in Durometer hardness offers a solution. But, in dynamic or pulsating pressure static seals it is preferable to use 70 Durometer O-rings with anti-extrusion rings on one side for a single action seal, or on both sides for a double acting seal, as the fatigue resistance of elastomers decreases with increases in Durometer.

• **Friction**—For any given dynamic O-ring seal at zero psi, frictional resistance is entirely caused by the O-ring's internal force against the moving surface, and hence is directly proportional to squeeze. At 200 psi about 50 percent of the total friction is due to squeeze. Thus, up to 200 psi reduction of squeeze to the lowest possible value consistent with sealing offers an effective way to reduce friction. When this is the case, the clearance gap is important as a means of maintaining equivalence of squeeze around the periphery of the ring. Equivalence of squeeze, and hence clearance gap, is also of great importance in very long stroke dynamic seals under moderate to high pressure.

• **Groove Shapes**—Figure 2 illustrates the normal gland design for reciprocating seals without anti-extrusion rings. Groove walls may incline up to 5° from the vertical. Actually the preferred configuration is 0°, and the 5° figure is for easier

Continued on page 134

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• By John A. Lankester

AH's European editor reports on one of the developments in hydraulic devices carried out by the British National Institute of Agricultural Engineering.

HOW

OIL pressure developed by a draw-bar dynamometer indicates draw-bar pull of farm tractors. This device is used to tell how much traction is needed to drag an implement through various types of soil.

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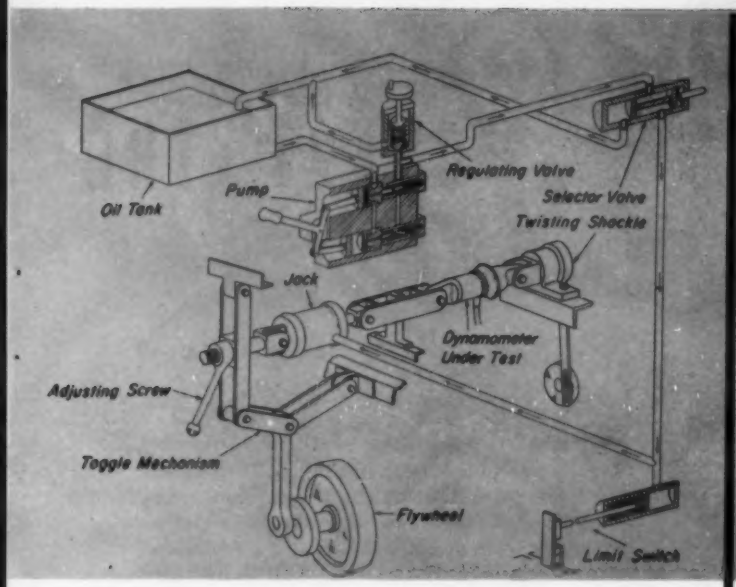
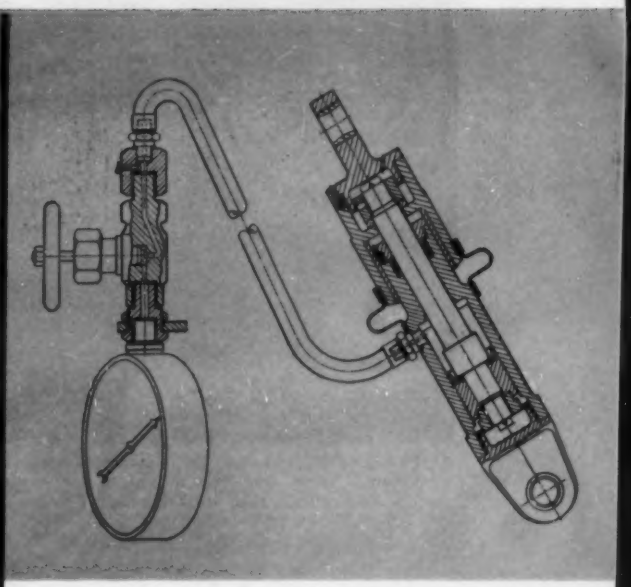
• **Dynamometer design**—The tractor draw-bar dynamometer is a hydraulic cylinder and piston similar to the ordinary hydraulic ram. This unit is completely filled with oil and is attached between the tractor and the implement



CALIBRATION of dynamometers is done on this test rig. Varying load is applied by the flywheel powered through the toggle mechanism by the jack.



DYNAMOMETER construction is shown. Oil pressure acts on a gauge which reads pounds pull.

HYDRAULICS MEASURES TRACTOR PULL

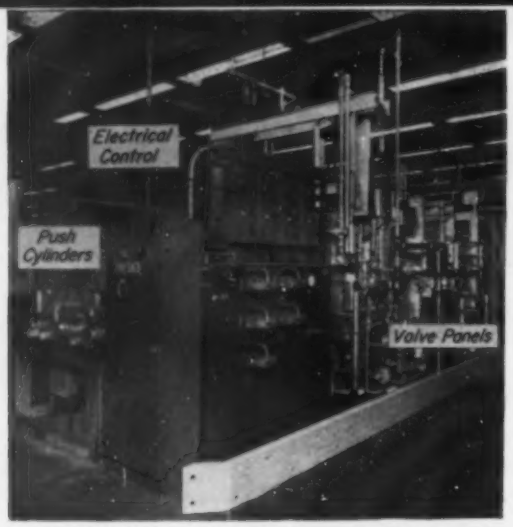
which is being towed. The oil chamber of the cylinder is connected by means of a flexible pressure line to an ordinary hydraulic pressure gauge and when the tractor starts to pull, the oil is forced through the flexible pipe into the pressure gauge and causes a deflection. This gauge is calibrated to give a direct reading in pounds pull exerted by the tractor in towing its trailer.

• **Allowable friction**—Internal friction in the dynamometer is important. It has been found that normally this internal friction can give a divergence in the order of plus or minus 2% at full load, and for the normal types of draw-bar pull testing plus or minus 3% is fixed as the acceptable maximum. If the internal friction exceeds this amount, investigation of the cause must be made. A small amount of oil leakage is not detrimental though obviously the oil sealing must be sufficiently effective to enable the dynamometer to continue in operation for about ten hours to cover any normal test period requirements. With the modern types of gland packings now available little difficulty is experienced in achieving a sufficiently good oil seal.

A free swivel at either end of the dynamometer is provided so that the instrument is not subjected to a bending moment which would, by increasing the friction, result in errors in readings. A fine regulating valve next to the gauge provides the necessary degree of damping so that the needle can be accurately read. This valve also protects the gauge from overload, since it can be completely shut off in circumstances when temporary excessive loads may be experienced.

The test starts with the valve completely shut off. It is then opened gradually until a sufficiently lively movement of the needle indicates a reasonable amount of damping. The grade of oil normally used for these dynamometers is SAE 20.

• **Use of a test rig**—Calibration and testing of these dynamometers is done on a test rig. On this rig a hydraulic pump supplies oil to a hydraulic jack, which reproduces the pull of the tractor draw-bar. This jack is connected to the dynamometer under test and by means of a flywheel and toggle mechanism, reciprocating motion, giving in effect variations in draw-bar pull, can be applied. A cam operated twisting mechanism is also used to apply a torque or twisting action to the dynamometer under test. While one end of the dynamometer is held rigid in a framework, this twisting action is applied to the other end in order to minimize break-out friction or any frictional resistance. In this way very accurate readings can be obtained, as all frictional resistance in the draw-bar dynamometer movement is eliminated. This friction-free operation of the cylinder piston assembly is of importance during calibration and checking. ▼▼▼



A SPEED CONTROL VALVE is mounted between the directional valve and the sub-plate on the valve panels controlling this heat-treating furnace.

CHART THE

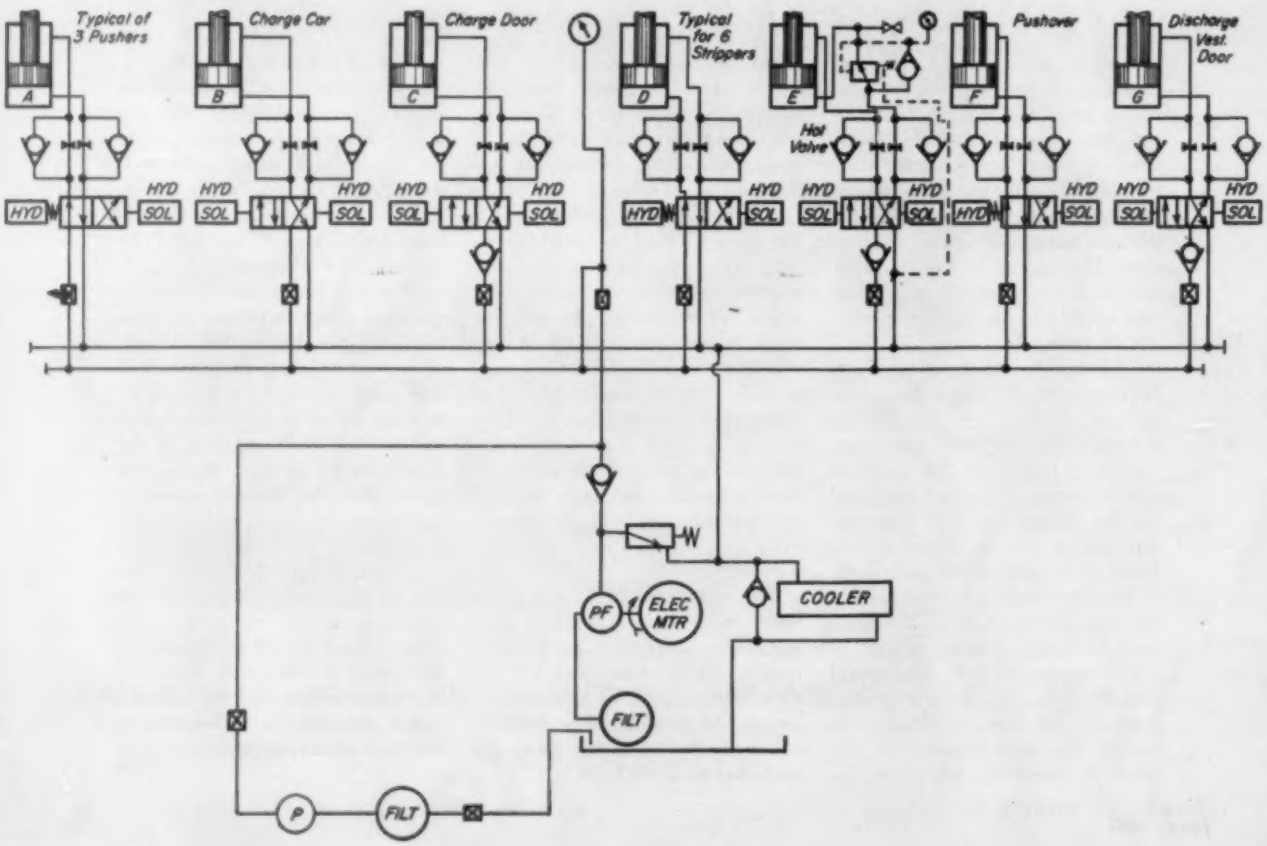
• By Harold A. Yarnell

With 14 cylinders acting individually and in combination, selecting the right size pump required a detailed analysis of the duty cycle on this heat treating furnace.

AUTOMATIC operation of heat treating furnaces is the job of hydraulic systems designed at Surface Combustion Corporation in Toledo. Opening the loading and unloading doors, inserting and removing the work pieces, and moving the work along within the furnace are all functions of the hydraulic system.

On one radiant tube furnace built for carburizing gears, 14 cylinders are required to control the various operations of the furnace. These cylinders range in stroke to 72 inches and bore to 4 inches. They are controlled by 2-position, ¾-inch, solenoid-con-

HAROLD A. YARNELL, *Design Engineer, Surface Combustion Corporation, Toledo, Ohio*



DUTY CYCLE

. . . to determine power requirements

trolled, pilot-operated, 4-way valves which are either spring off-set or have no springs.

The 6-row, surface pusher type carburizer has three pushers which push two rows each into the furnace. Six strippers then pull one tray at a time from each of the six rows. To maintain atmosphere purity within the furnace, two discharge doors and two charge doors with purging vestibules are used. Work passes through the furnace by loading the charge car and pushing the work into a charge vestibule. The door on the back end of the car seals the vestibule from atmosphere. After a purging period, the charge door opens and the pushers push the work from the charge car into the furnace.

On the discharge end, the strippers advance with a wedge-shaped action, sliding under a tray and carrying it back a sufficient distance to clear any interferences. The tray then passes under a wiping bar which wipes the tray off the wedge.

An inner door is opened to allow a pushover arm to push one stripped tray sideways across the furnace, behind the adjacent rows into a discharge vestibule. Because this door is installed inside the furnace, it heats up and expands when closed, and cools down and contracts when opened. Full line pressure is applied to the rod end of the *Hot Valve* cylinder to open the door. However reduced pressure is applied to the head end to close the door.

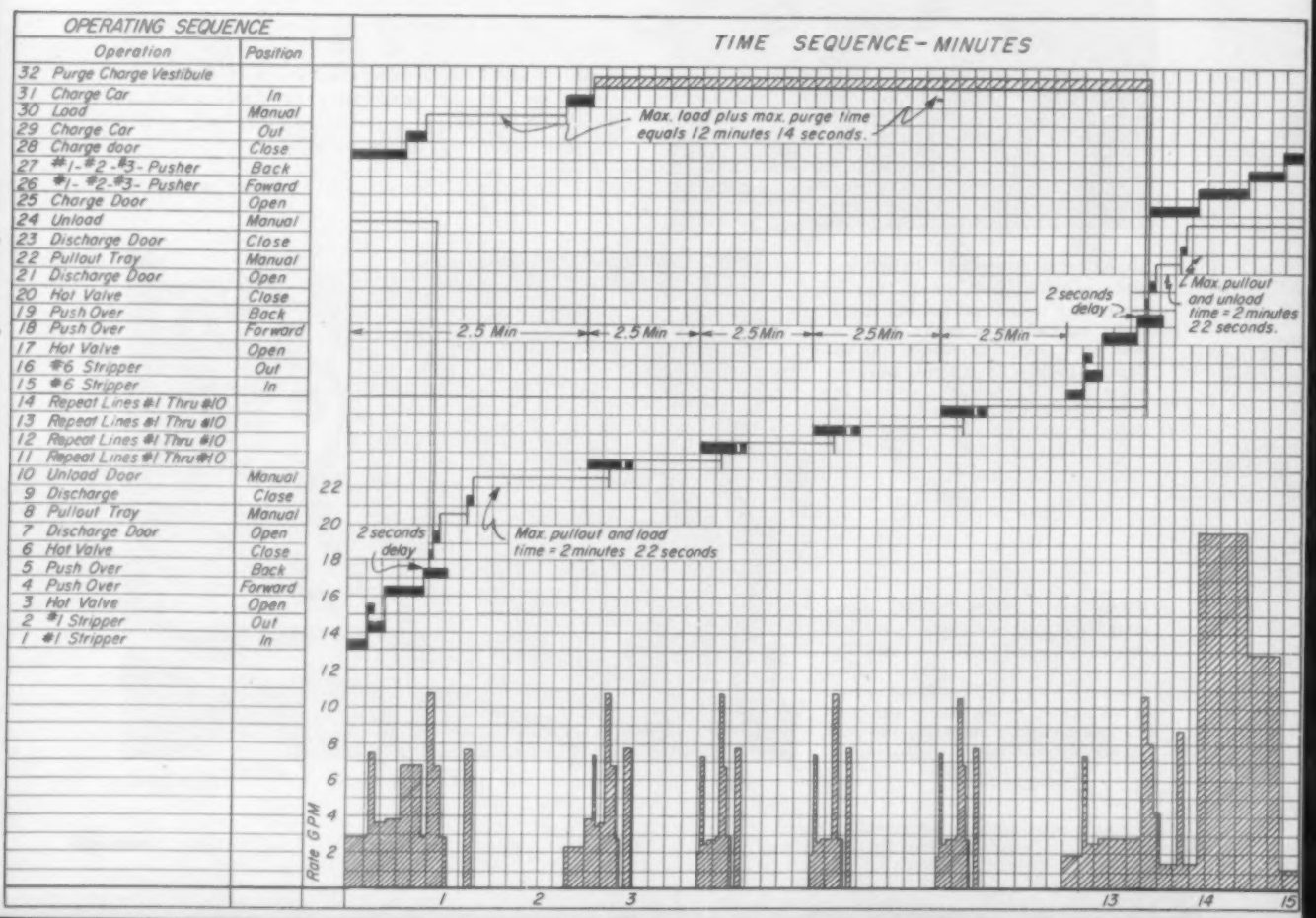
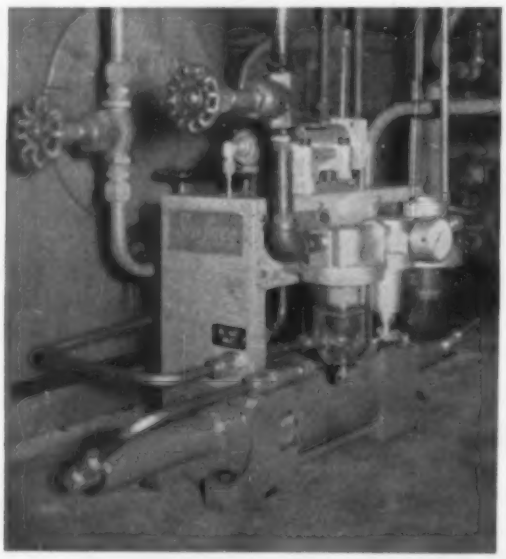


CHART THE DUTY CYCLE

DUTY CYCLE CHART

To tabulate the hydraulic system requirements during one cycle of the furnace, a chart of the complete duty cycle was drawn on the hydraulic circuit diagram. Each hydraulic operation is listed in one column according to its sequence in the cycle. The velocity of the operation, the distance over which it takes place and the required time are listed in succeeding columns. Data on the cylinder which performs the operation is listed correspondingly and includes bore, stroke, rod size, rod-end and blind-end areas, velocity, and flow requirements for extending and retracting.



The operating time is then charted next to the corresponding operation. On the same time scale, the total flow requirement is charted giving an accurate picture of the system requirements over the total cycle. The maximum flow requirement of 19.6 gpm occurs during operation of the three pushers, near the end of the total cycle.

POWER UNIT

The power unit designed for this application uses a 28-gpm, vane type pump driven by a 15-hp 1200 rpm, a-c electric motor. A 1¼-inch relief valve is set at 800 psi. The pump intake line includes a 60-mesh, in-line filter which uses the principle of edge filtration. It is recommended that the filter be thoroughly cleaned after the first 24 hours of operation.

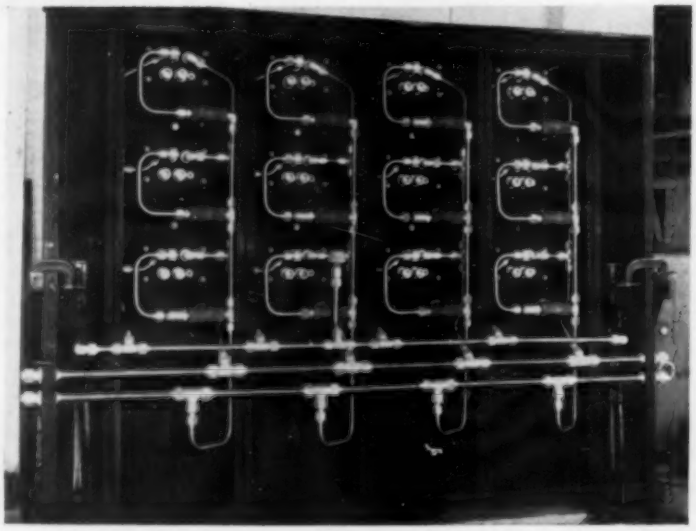
In order to maintain the temperature of the fluid below 120°F, an oil cooler is installed in the drain line of the relief valve. This oil cooler requires 14 gpm of water to maintain this oil temperature.

EMERGENCY PUMP

In addition to the main pump, an emergency pump is included in the power unit. This can supply both the hydraulic pilot system and the main pressure header in case of loss of electrical power. The solenoid covers on all valves have sliding pins to permit manual shifting of the pilot spool, and the valves are marked according to the operation which they control. The reason for these safety measures is the hazard of combustible gases inside the furnace if electrical power should be lost when one of the doors is open. In this emergency the decision must be made whether to close the doors and allow the work to remain in the furnace with a possibility of scrapping the work, or attempt to remove it before the doors are closed.

Concluded on page 94

AN AIR-OIL BOOSTER PUMP has replaced the hand pump as an emergency source permitting much faster operation to make the furnace safe. The unit which was designed specifically for this purpose operates only when there is a requirement for fluid and stalls when fluid is not required.



REAR OF VALVE PANEL shows simplified tubing runs achieved through several redesigns and the use of the speed control valves mounted with the directional valves. A wire raceway on top of the panels and terminal blocks in the panels simplify wiring to the solenoids.

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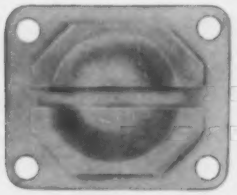

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CHART THE DUTY CYCLE

Concluded from page 92

The emergency pump was originally a hand unit. However, the time of 20 to 25 minutes which the hand pump required to perform the functions under emergency conditions called for the design of a faster acting pump. An air-oil booster pump has been developed for this purpose.

The booster pump has an output of 2¼ gpm compared with the hand pump output of approximately .135 gpm based on a displacement of .78 cu. in./stroke and 40 strokes/min. This insures that the furnace is made safe as fast as possible. The air-oil booster pump can be operated from two bottles of nitrogen for 21 minutes, or it can be operated from the plant air supply. In the latter case a 100-gal air receiver with a check valve preventing loss of air pressure is recommended.

SPEED CONTROL VALVES

In order to regulate the speed of the various operations, speed control valves are installed with each 4-way valve. These valves are incorporated in a 2⅛-inch plate which is installed between the valve and the sub-plate. To adapt the speed control valve to the directional valve, an O-ring retainer plate is installed between the speed control valve and the directional valve. The speed control valve has two flow control valves with bypass checks. It is connected to meter flow from the cylinder with free flow to the cylinder. Two adjusting screws project from the valve.

To adjust the speed, it is recommended that both flow control valves be closed completely. This prevents movement of the cylinder, except for the slight slippage flow through the circuit. The valves are then adjusted for proper speed.

The use of these speed control valves permits mounting three directional control valves on a single standard panel instead of two. This shortens the overall length of the control panel and saves floor space.

VALVE PANELS

The standard valve panels are manufactured in lots of 100 to reduce costs, and they are designed to mount any standard sub-plate. A wire raceway along the top facilitates wiring through terminal blocks in each panel to the solenoid controlled valves. The standardization of the panels permits a simple "fix" if the tube fabricator crosses the tubes from the valve to the cylinder. The wires to the solenoids are reversed at the terminal block and the labeling is reversed. This saves re-piping time. ▼▼▼

Fluid Power for Fabricating Machinery
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GIANT OIL-DRIVEN

...control

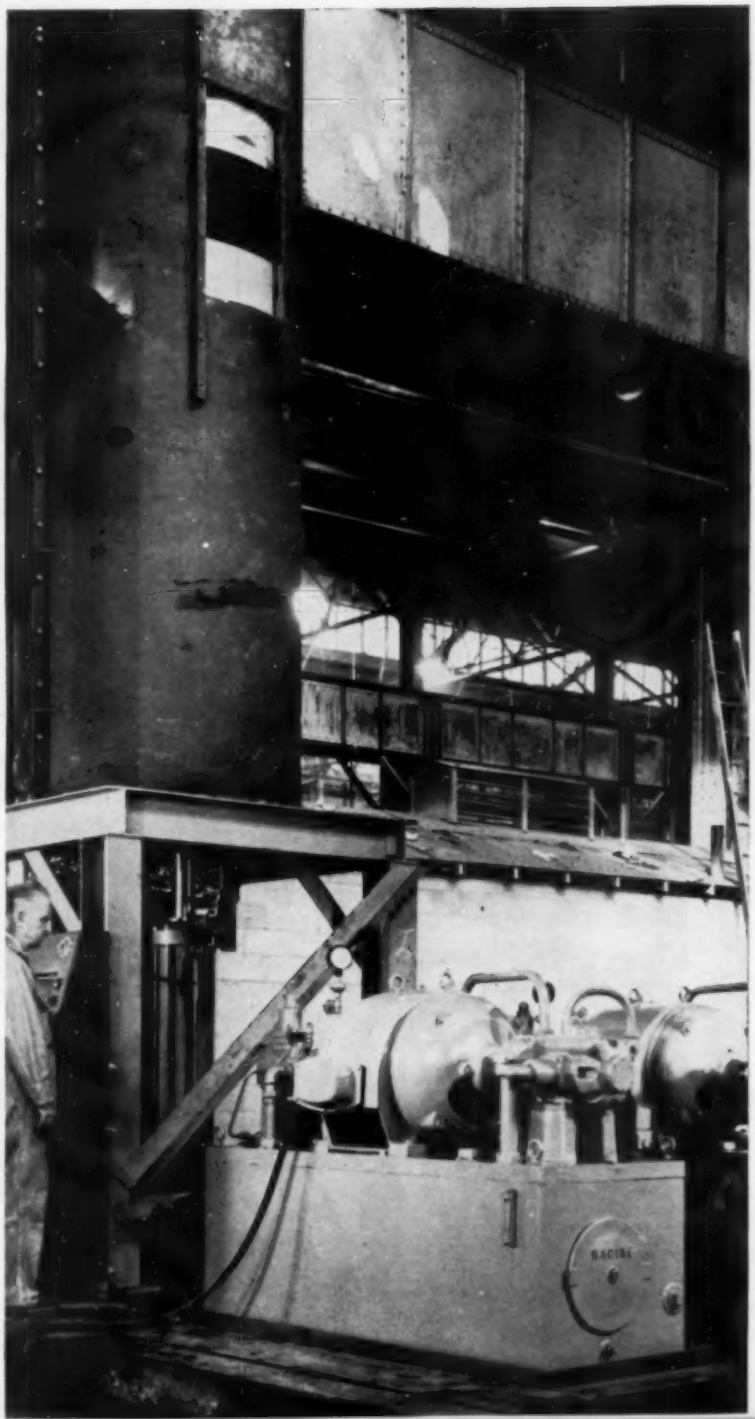
Medical research will be carried on this summer at Brookhaven with a nuclear reactor having a hydraulic drive as an important part of its control system.

COMBINATION of a large mass moving at high speed created hydraulic design problems which were solved in the construction of equipment being built for a medical research reactor. Two 42,500 lb. shutters, moving at 30 fpm to control thermal neutron radiation for medical research, will be installed this summer at the Brookhaven National Laboratory, Upton, N. Y. The large weldments were built by the Eddystone Division, Philadelphia, of Baldwin-Lima-Hamilton Corporation. They will permit Brookhaven to use its new reactor as a research tool in the field of experimental radiotherapy.

Previous applications required building the reactor up to strength before the experiment began and letting it die out at the end. The new hydraulically controlled shutters will admit a continuous beam at full strength for the entire treatment period. Opening or closing the shutters will give close control of the radiation, make treatment more flexible, and provide maximum safety for patients, scientists and technicians.

• **Construction**—Each shutter assembly consists of a welded half-cylinder casing in which a concentric half-cylinder moves. The shutter assemblies will be placed on opposite sides of the reactor. Both the inner cylinder, which moves, and the stationary outer cylinder, have square openings. When these openings are matched, the shutter is open and radiation passes through a treatment port into the room.

• **Mass**—Except for the shutter opening, the entire volume of each shutter cylinder is filled with heavy concrete as a shield against radiation when the shutter is closed. Each shutter is 15 feet high, 4 feet wide and 31 inches thick at its mid-section. Filled with heavy concrete, which weighs 280 lbs. per cu. ft. as compared to 130 to 140 lbs. for regular concrete, the finished shutters will weigh over 21 tons.

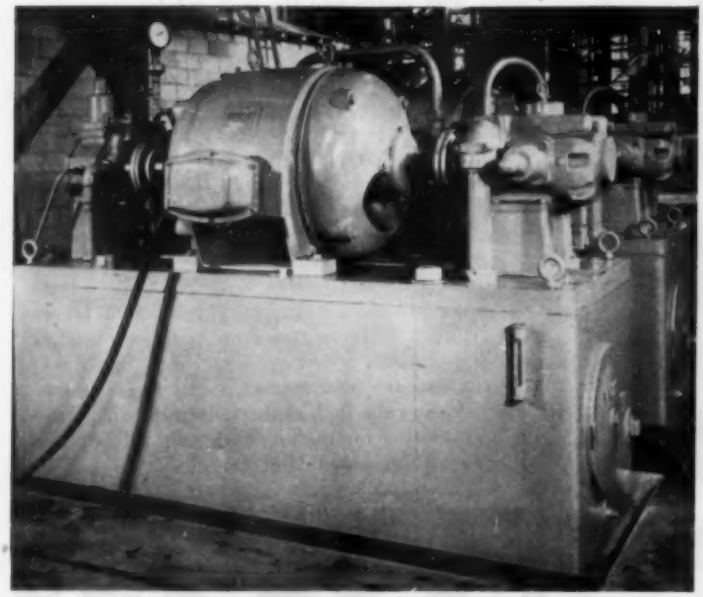


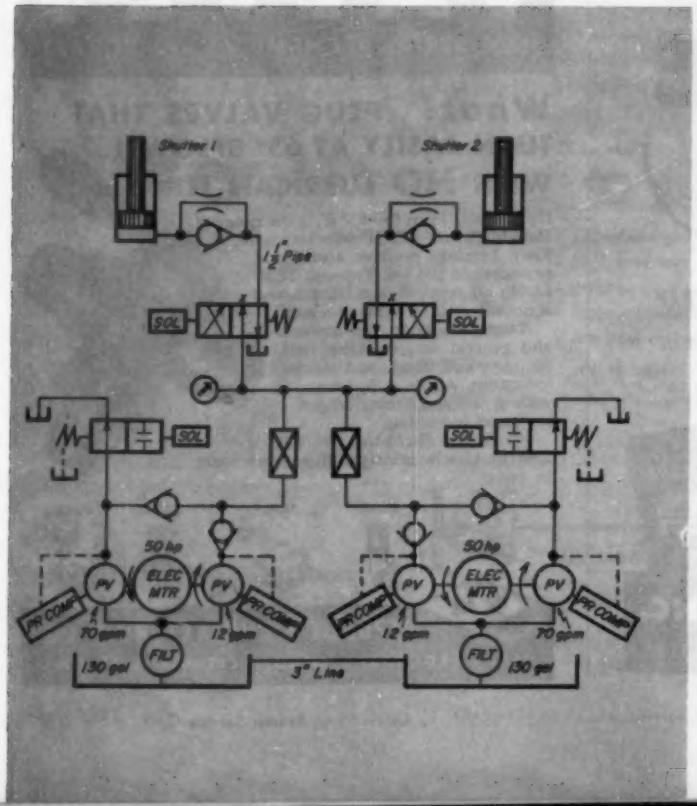
ROBERT P. STODDART, *Mechanical Engineer, Eddystone Division, Baldwin-Lima-Hamilton Corp. Philadelphia.*

SHUTTERS

thermal neutron radiation

• By Robert P. Stoddart





• **Speed**—The shutters must move from completely closed to completely open in 10 to 11 seconds, or 30 fpm through a distance of 4 ft.-3in., including time for acceleration and deceleration.

• **Hydraulic system**—Originally, pressures of 250 psi were specified, which would require two 10 in. cylinders and two pumps with a total capacity of 276 gpm for each shutter. Both price and size were prohibitive.

B-L-H engineers recommended one 8 in. cylinder for each shutter and system pressure of 1000 psi. For each shutter the system uses one high-volume pump at 70 gpm and one low-volume pump at 12 gpm. Each pump is a variable volume type with automatic governor control. Each pumping unit consists of two pumps, one mounted at each end of a 50 hp electric motor. The pumps are connected to the motor by flexible couplings and the whole unit is mounted on an oil reservoir of sufficient capacity for the entire system, including the lift cylinders of both shutters. The large reservoir capacity is needed on each pumping system as only one unit is used at a time.

• **Control**—The shutters will be operated by doctors from a console located near shielded windows which view the treatment ports. The shutters are raised by position-

FLOW OF RADIATION into a treatment room is controlled by shutter opening. A fifty horsepower drive supplies oil to lift the two 21-ton shutters.

EACH PUMPING UNIT consists of a 50 hp electric motor driving 70 gpm and 12 gpm, variable volume pumps. Only one unit operates at a time and operates both shutters. The second unit is on standby.

LIFT CYLINDERS are inter-connected in this circuit to operate from either pumping unit, but not simultaneously. High volume pump lifts shutter at 30 fpm. Then low volume pump decelerates and supports the shutter in open position.

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GIANT OIL DRIVEN SHUTTERS

Concluded from page 97

ing a selector switch for one of the pump motors, pressing the start button and then the up button for one of the shutters. An interlock prevents the second shutter from rising until the first shutter is fully open.

Both the high and low volume pumps for the unit selected will deliver full volume to the lifting cylinder until the shutter is within two inches of the upper stop. There a cam wiped by the slow-down limit switch and the high volume pump by-passes. Operating on only the low volume pump, the shutter meets the upper stop at slow speed and is held by the low volume pump running at minimum horsepower because of variable volume control.

When the first shutter is fully open, switches release an interlock and permit the first pumping unit to raise the second shutter. A check valve prevents drift of the first shutter while the second is being raised.

The shutters move down by gravity, with speed controlled by size of orifice through which oil leaves the cylinder. Shutters also drop and close in case of power failure.

Cylinders are inter-connected and either pumping unit can raise both shutters. Intentionally, there is no provision for running both units at the same time to lift the shutters simultaneously. ▼▼▼

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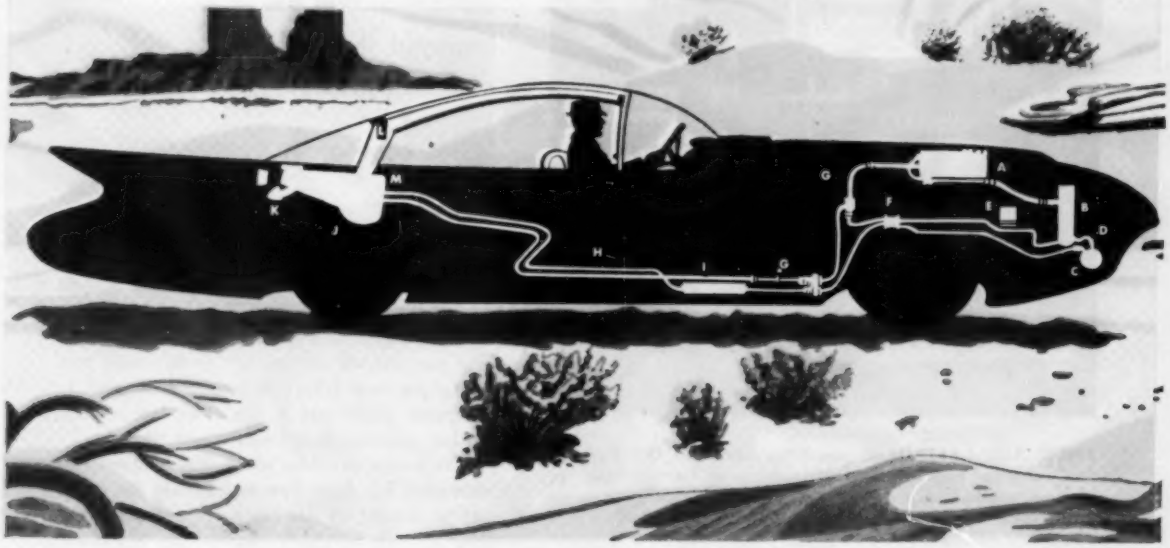

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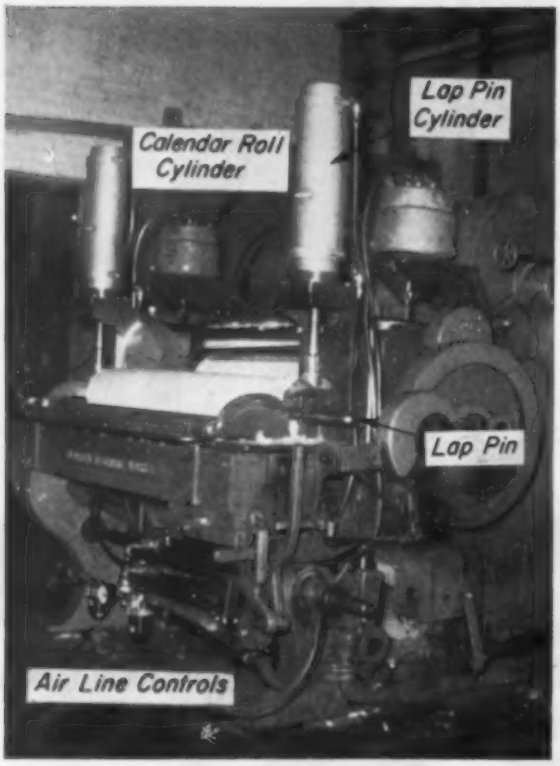


FOUR AIR CYLINDERS applying force to the lap pin and calendar roll of this textile machine have greatly increased production and quality. Smooth, pneumatic force application replaces former mechanical methods.

AIR CYLINDERS

... improve a traditional textile machine

• By A. C. Flint

Some time in his career, every engineer has heard the frustrating statement, "It's always been done this way." Here's a simple pneumatic application that has improved the performance of a time-honored textile machine.

MANUFACTURERS of textile machines have used the same basic designs for many years. Recently an effective pneumatic system was applied to a *picker* which is a basic machine in cotton and synthetic fiber processing. The purpose of the picker is to clean and straighten raw fibers from the bale and to compress them into a *lap*. The lap is then further processed and spun into thread.

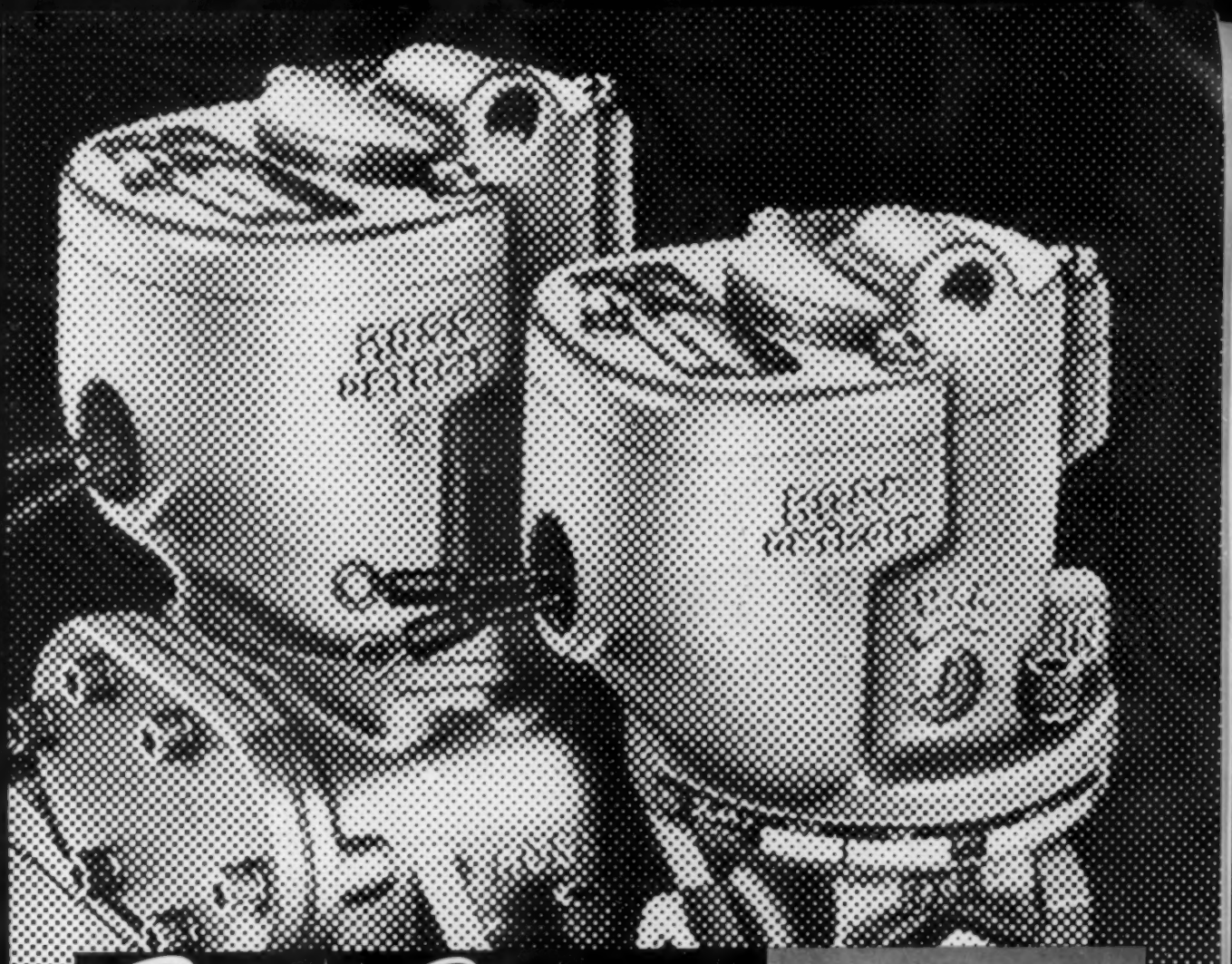
One major problem which has plagued this operation has been how to increase the quantity or weight of the lap to increase production without materially increasing the width or diameter of the lap. The pneumatic system accomplishes this by applying a higher, better controlled force on the machine rollers.

In operation, the picker puts the cotton through a beater section in which it is beaten, and then through a fan section where a lap is built by blowing the fibers onto a screen. The material is then rolled out and fed to the calendar roll section where it is compressed. The calendar rolls then deliver the lap to *fluted* calendar rolls and then to the lap pin which is then removed for further processing.

To exert force on the fluid calendar roll for compressing the material, either a friction brake arrangement working through two loggerheads or a rack and pinion mechanism operated by an air cylinder and functioning through two loggerheads was formerly used. The old method of exerting force on the calendar rolls was to load it with weights. The forces which could be applied in this way were limited, and the method was very inflexible when a variable force was required.

A. C. FLINT, *Vice President, Livingston & Haven, Inc., Charleston, S. C.*

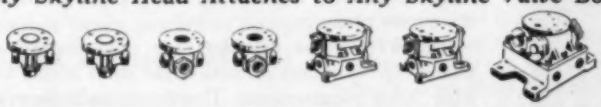
Circle 106 ⟶



Ross Skyline

Silvermodel JIC Spool Solenoid

Any Skyline Head Attaches to Any Skyline Valve Body



Interchangeable! 25 Million Cycles in Tests!

Now the JIC spool solenoid valves join the Ross Skyline. Now six actuating heads and seven in-line and base mounted bodies—all completely interchangeable—give you any valve you want in this series designed especially to last millions more cycles than ordinary valves. But, these quality valves come to you at *sensible* prices! For instance, the ⅜" Silvermodel base mounted, 4-way is only $62.50 complete, and complies with all JIC requirements. Write for bulletin 315.

Ross OPERATING VALVE COMPANY

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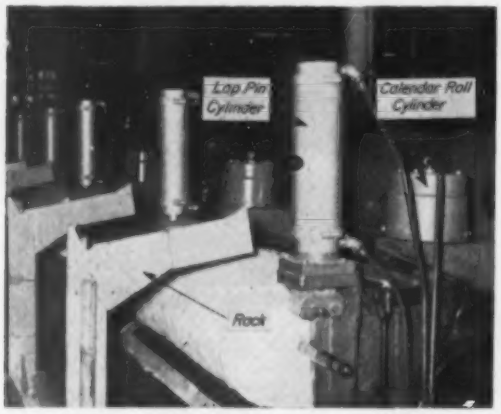
AIR CYLINDERS IMPROVE TEXTILE MACHINE

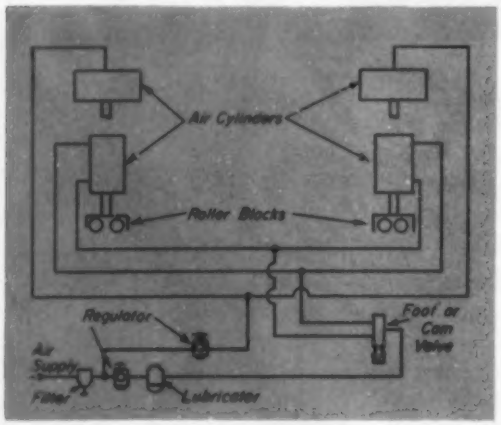
Fast removal of the force at the end of the operation was also recognized as desirable by the designer of the system, J. Russell Long of Shuford Mills in Hickory, N. C. The hand-wheel method used with the friction brake and rack and pinion arrangements slowed production.

FLUTED CALENDAR ROLL SYSTEM

Two major disadvantages were evident in the original machines. First, it was extremely difficult to insure an even pressure on both ends of the lap because of the limited adjustment that could be made on the loggerheads. One loggerhead could be raised higher than the other, so that forces on each side might not be equal. The second disadvantage was that the let-off depended on friction and was extremely rough. As the lap was being built, the force varied as much as 300 lbs. between the time that the rack and pinion or friction brake slipped, and enough friction was exerted to slip either of these again.



INSTALLATION OF PICKERS equipped with pneumatic loading is shown in a large textile mill. Laps have been completed and lap pin cylinders are retracted. Racks at left are also air operated to raise heavy laps to a conveyor.



INDIVIDUAL REGULATORS are installed for each set of cylinders permitting individual setting of roller force according to the fibers being processed. Valve is actuated when picker is started to extend roller blocks to lap pin.

Because a smooth and even let-off was desirable, it was decided that the friction arrangement must be eliminated. An equal pressure could only be obtained by using air cylinders on each end of the lap pin. Since pressure is maintained on the top of the cylinders while the lap is being built, it was necessary to use a self-relieving pressure regulator to exhaust the excess air to atmosphere, and yet maintain the pressure in the cylinders at the set value.

When the picker is started, the cylinders at each end of the lap pin extend and the roller blocks mounted on their pistons bear against the lap pin. When the lap is completed, the picker stops and the cylinders retract automatically eliminating the manual effort formerly required in raising the loggerheads.

Approximately 9500 lb force can be exerted on each side of the lap pin by the 5-inch cylinders. By using $\frac{5}{8}$-inch tubing to the control valve, and $\frac{1}{2}$-inch tubing to the cylinders, the proper speed has been obtained without resorting to flow control valves.

BACK CALENDAR ROLL SYSTEM

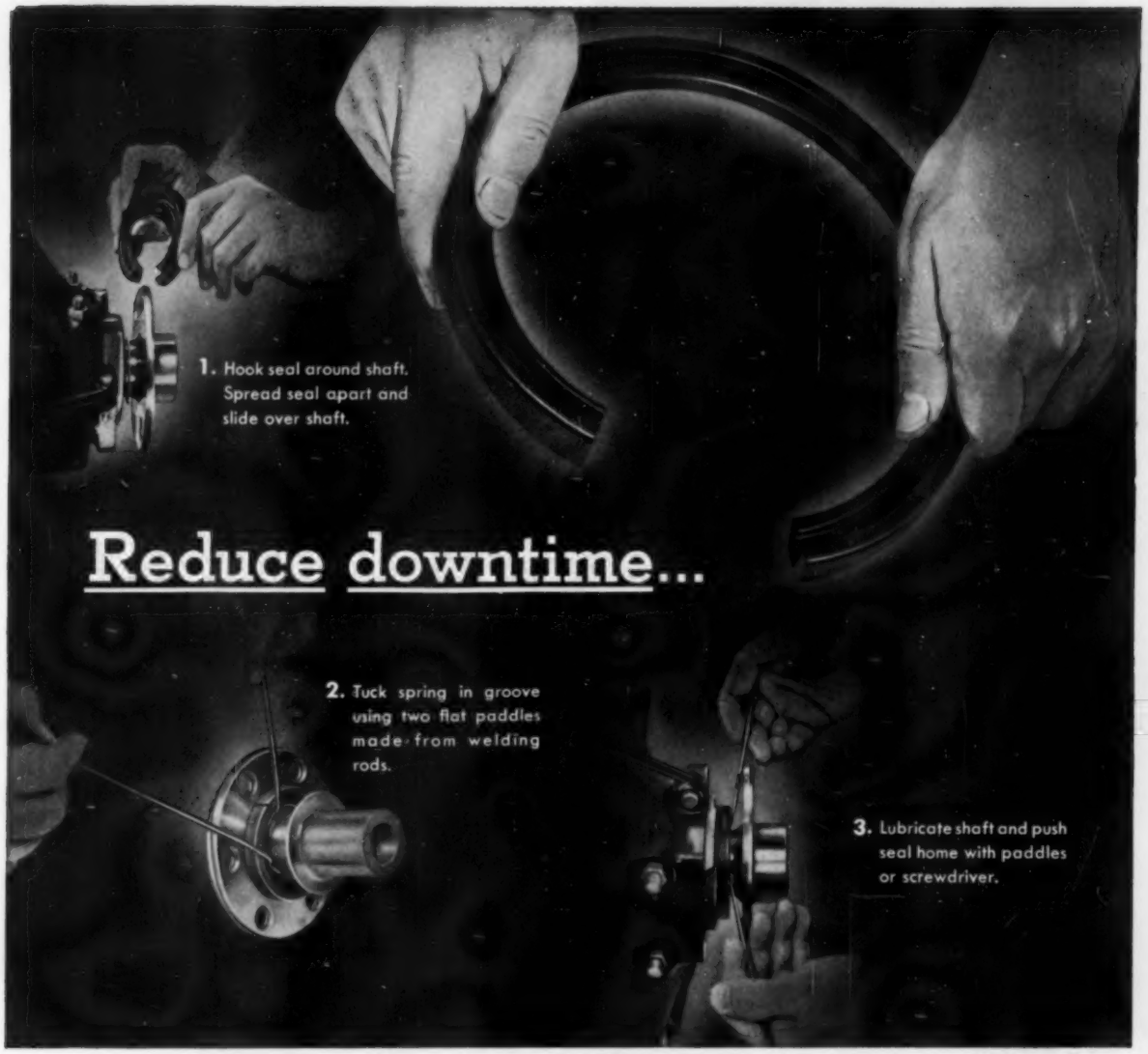
A further increase in production and quality was achieved by re-designing the loading system for the calendar rolls. This was formerly done by dead weights acting through a lever system. However this arrangement had limited flexibility which was a disadvantage because of the tendency to damage the fiber and the equipment if too much force was applied. Pneumatic loading has not only given greater flexibility, but has insured equal loading on both sides of the roll resulting in a higher quality output.

A relieving type regulator was selected for this circuit also, to maintain an even pressure at all times. In case of an uneven distribution of incoming material, causing a choke-up, this regulator relieves the excess pressure.

Diaphragm type cylinders are used instead of piston type cylinders because of the short stroke and high force requirements. The 8-inch cylinders act through a lever system with an advantage of 7:4, and forces up to 800 lb are exerted on each side of the calendar roll.

Reduction of maintenance was an important factor in designing these systems. The cylinders used in the counter roll system are subject to side loads if the lap pin is bent and O-ring packings are required. A filter and lubricator are used to protect the components, and no cylinder or valve failures have occurred in over one year of operation. ▼▼▼

Patents are pending on both systems described in this article.


1. Hook seal around shaft. Spread seal apart and slide over shaft.
Reduce downtime...
2. Tuck spring in groove using two flat paddles made from welding rods.
3. Lubricate shaft and push seal home with paddles or screwdriver.

How J-M Split Clipper Seals speed installation

. . . flexible body provides easy installation and removal even with small clearances

"Downtime" is measured in seconds when Clipper Seals do your sealing. Furnished in split form and made from a highly flexible synthetic rubber compound, they can be readily slipped into the tightest spots. Neither special training nor special tools are required . . . no drilling and tapping for cover plates is necessary because cover plates are not needed.

Clipper Seals are virtually fracture-proof and stand up well under rough handling by inexperienced mechanics. The self-adjusting garter spring has a hook and eye which is easily hooked around the shaft. It is then a simple procedure to slip it into the groove. When the shaft end is accessible, solid seals are used and snap into place almost as quickly as you can say "Clipper Seal." What's more, they stay put.

Reduced "downtime" is only one of many advantages you get with J-M Clipper Seals. Precision moulded from a variety of corrosion-resistant compounds specially developed for each service, they provide maximum sealing ability, low torque, long life and wide adaptability. For more information on the complete line of Clipper Seals, write for new 28-page illustrated brochure PK-71A. Address Johns-Manville, Box 14, New York 16, New York. In Canada, Port Credit, Ontario.

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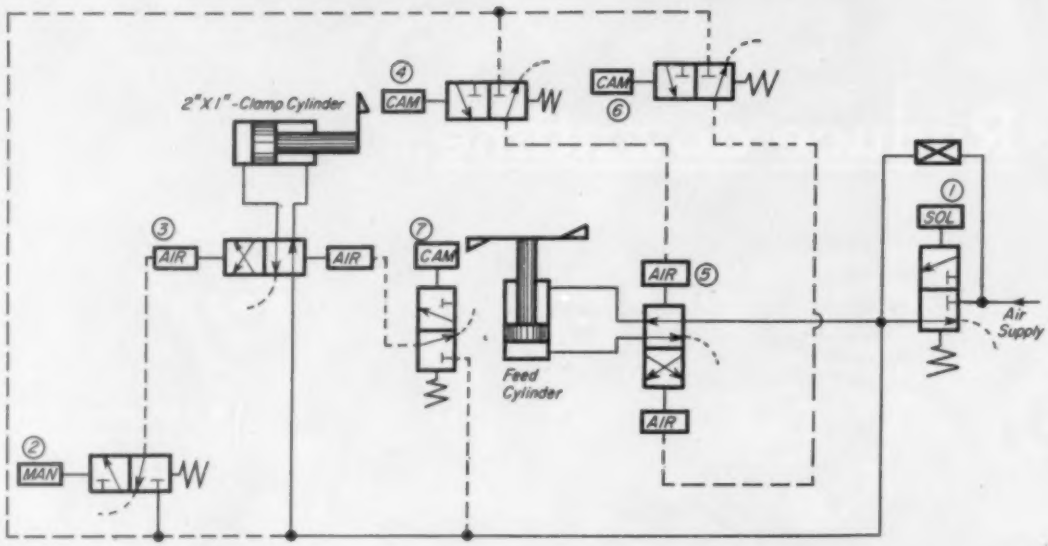


SLOTTING Over-riding cams trip pilot valves to actuate directional controls. Valves are numbered on both circuit drawings to show the sequence in which they are operated.

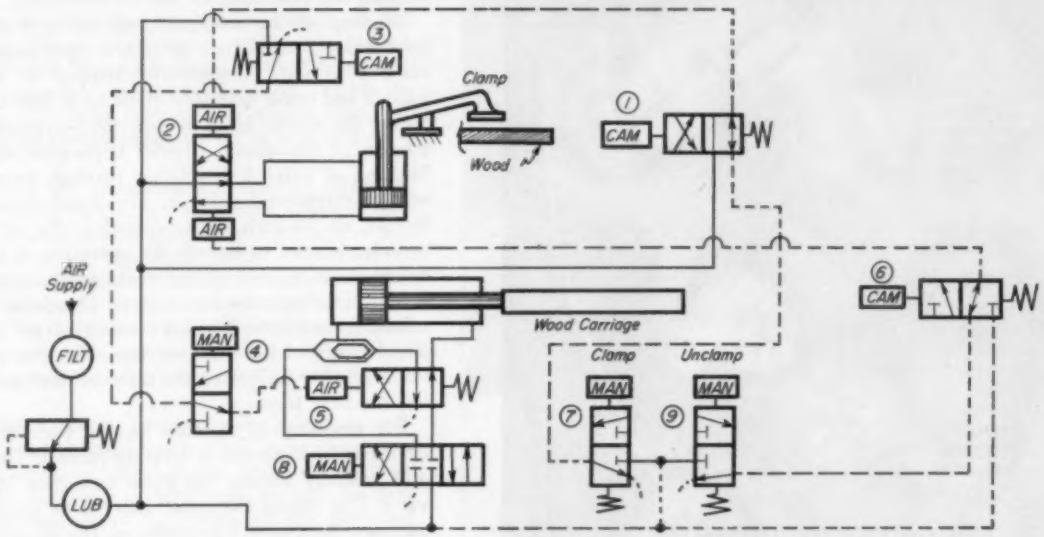
Safety, speed and product quality have resulted in the application of air controls on window sash production machines.

LOW COST AIR

• By Norman Hope and Andrew Damer

TWO machines converted from manual-mechanical operation to semi-automatic air operation illustrate what can be done in small shops to improve quality and productivity. Small, low cost pilot and cam operated valves control the automatic cycle which is initiated by hand or foot operated valves.

NORMAN HOPE, *Superior Sash Co.*, ANDREW DAMER, *John Spotton Ltd., Toronto, Canada*



TENONING **Circuit is designed to permit automatic or manual cycling. Valve 4 is shown in position to allow an automatic cycle to be initiated when loading of the workpiece momentarily trips valve 1.**

CIRCUITRY... *speeds woodworking operations*

Circuit design provides for a safe, automatic cycle.

Versatility in a small shop is extremely important. Many different window sash members are machined on this equipment. Simple, quick adjustments permit production of parts having variable lengths.

• **Slotting machine**—There's an effective safety feature built into this circuit. It's an electrical interlock which permits air flow to the circuit through solenoid valve 1 only if all three electric motors on the machine are in use. These motors drive the slotting saw, side saw and dust exhaust. Valve 1 is bypassed by a globe valve for testing air cylinder action without operating the machine.

With a workpiece loaded against a stop, and all motors running, the operator depresses the pedal

Concluded on next page

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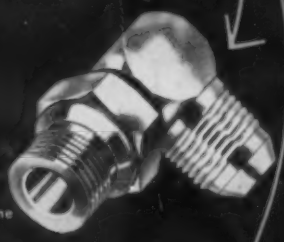

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- Choice of outlets
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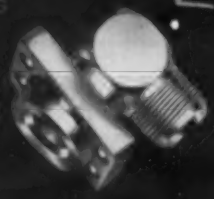
- Designed for quick installation
- Eliminates pipe thread connections
- Choice of wide selection of outlets



Other outstanding features:

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LOW COST AIR CIRCUITRY

Concluded from page 105

on valve 2. From this point, the cycle is automatically maintained by pilot and cam operated valves. Valve 3 shifts to cause the clamp cylinder to act through its 1 inch stroke and strike valve 4 with an over-riding cam. Valve 5 shifts. The feed cylinder, which is cushioned at both ends, feeds the work vertically through the saws. At the end of the work stroke, cam valve 6 is tripped causing reversal of valve 5 and lowering of the feed cylinder. An over-riding cam trips valve 7 to release the work clamp.

• **Tenoning machine**—Air pressure is regulated at about 110 psi to power the clamp and feed cylinders on this machine.

Loading of the workpiece against a stop trips pilot valve 1 to initiate automatic operation. Cam valve 1 is only momentarily tripped to actuate valve 2 and cause extension of clamp cylinder which moves the clamp lever to grip the workpiece. Extension of the clamp cylinder trips pilot valve 3. Shifting of valve 3 directs air through valve 4 to actuate directional valve 5. The wood carriage is fed by an 18 inch stroke cylinder. An oil check cylinder is used to smooth the operation of this air cylinder. At the end of the work stroke, cam valve 6 is hit, causing valve 2 to reverse. The clamp opens, releasing cam valve 3 which causes reversal of valve 5 and return of the wood carriage. The next cycle is initiated after unloading the finished part and loading the next piece.

For tenoning of random lengths the automatic cycle can be bypassed by shifting valve 4. The operator visually locates the piece and then operates valve 7 to clamp the part; valve 8 to control the carriage; and valve 9 to unclamp. The closed center neutral position of valve 8 gives the operator stop, start and creep control to position a random length. A shuttle valve permits valve 8 to bypass valve 5 on manual feed. With the selection of either automatic or manual operation, the circuit provides flexibility for handling many different lengths of work. ▼▼▼

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AIR and OIL CIRCUITS GUIDE

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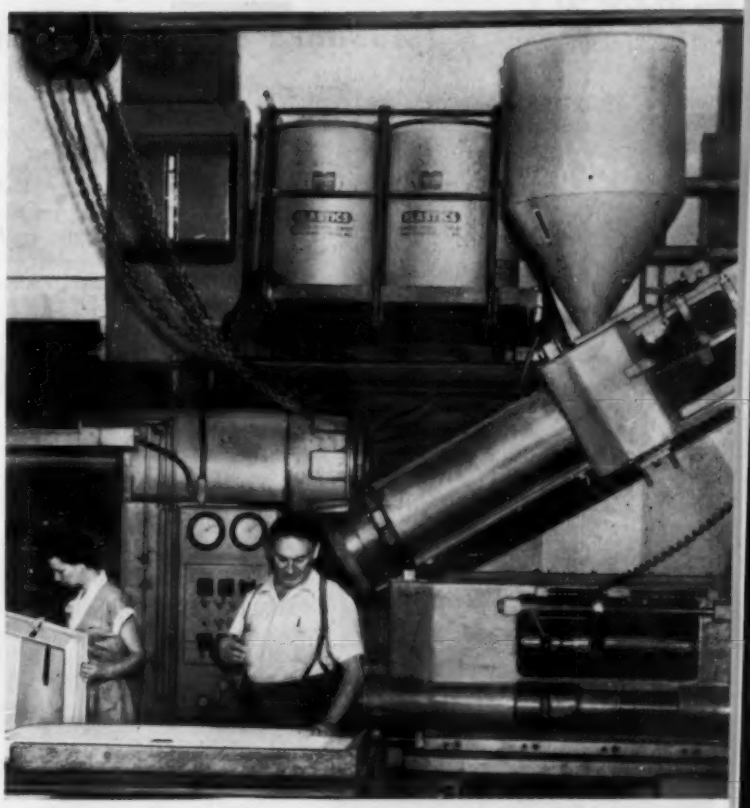
A STANDARD OIL product and technical service help plastics molder

Standard men and STANOIL Industrial Oil aid General Machine & Tool Works in getting top performance from injection molders.



General Machine & Tool Works, Walled Lake, Michigan, has had 12 years' experience with STANOIL Industrial Oil and Standard Oil Company technical service. The experience has been rewarding. Plastic injection molding machines, equipped with STANOIL Industrial Oil 12 years ago, are still using this same hydraulic fluid. The equipment operates with minimum servicing attention, and only minimum make-up oil is required.

A Standard Oil industrial lubrication specialist, L. H. Walker, began working with General Machine management in 1945, after competitive oils had been tried. Machines were converted to STANOIL, and Lyman Walker initiated regular six-month checks on the performance of the oil. In addition, he helped plant management install a portable filtering system so that the oil could be filtered completely about every two months.

The Kovacs brothers, Andrew and George, founders of General Machine & Tool, are more than just operators of an injection molding business. They are designers of equipment as well. So part of the technical service Lyman Walker provided the Kovacs was engineering information about lubricants and lubrication procedure. Men who have succeded Lyman Walker in serving this plant continue to keep the Kovacs up-to-date.

Today, 15 plastic injection molding machines are operating at General Machine & Tool Works. All use STANOIL Industrial Oil. Included in this list of equipment is the giant Watson-Stillman 400-ounce injection molder—the world's largest. A 300-ounce machine is likewise getting top performance from STANOIL Industrial Oil.

Get facts about STANOIL Industrial Oil and get this kind of technical service as well. Call the Standard Oil office near you in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Quick facts about

STANOIL Industrial Oil

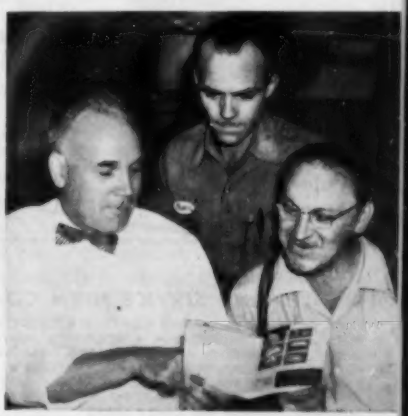
- Antioxidant gives oil resistance to chemical change, minimizes deposits.
- Inhibitor "plates out" on metal surfaces, prevents corrosion.
- Refined to eliminate emulsion problems. Contains additive to minimize foaming.
- Low pour point. Flows freely from cold start. Needs no warm-up.
- High viscosity index. Resists temperature change.

George Kovacs and plant superintendent check refrigerator door liner, world's largest individual molded part. Many special features of the 400-ounce plastics machine were designed by Kovacs brothers, owners of General Machine & Tool Works.

Walter Spain, Standard Oil industrial lubrication specialist, goes over STANOIL literature with plant superintendent, Owen Pierce, and General Machine & Tool Works president, George Kovacs. Supplying lubrication information and technical service to customers is something for which Walt Spain is well qualified. He has been doing such work for 23 years. Walt got his engineering training at Virginia Polytechnic Institute. He has also completed the Standard Oil Sales Engineering School.

STANDARD

STANDARD OIL COMPANY (Indiana)



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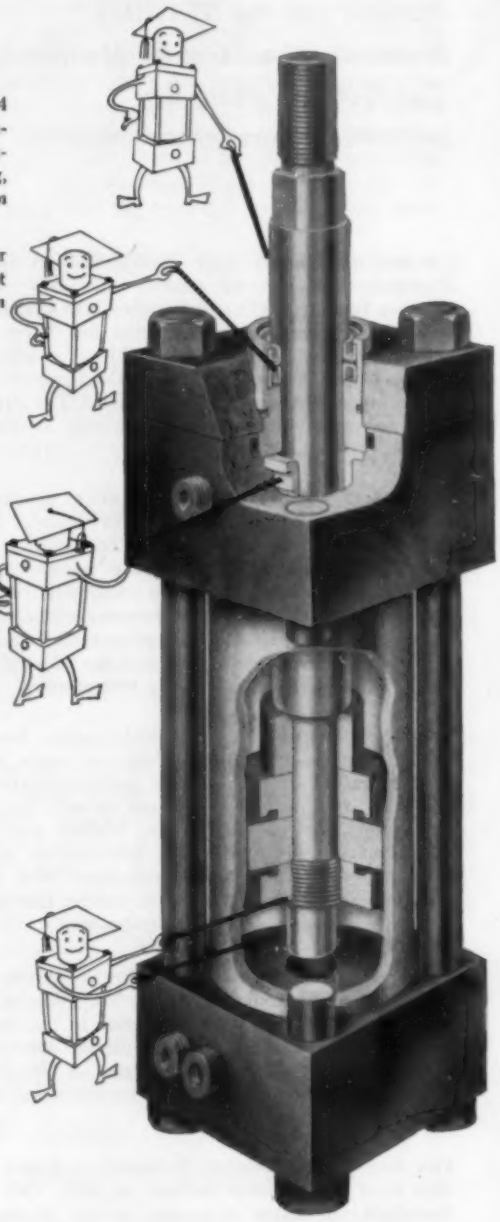
Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods have this finish ***at no extra cost on all Miller cylinders.*** (This finish not recommended for water service)



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HYDRAULIC DRIVE AND LEVEL WIND

. . . for a mobile winch

• By Robert J. Schrader and Joseph F. Weinum

DESIGN of a military vehicle for hoisting and towing in cross-country operations under battlefield conditions required complete protection of winches and the operating crew. This made the use of a commercially available winch impossible since the conditions dictated complete enclosure of the winch within the vehicle and commercially available units are designed for exposed mounting at either the front or rear of the vehicle. A detailed design analysis of conditions and the characteristics of possible power transmission methods led to selection of a hydrostatic transmission.

Among the most important considerations in the selection of this transmission was the comparatively small size required to provide the necessary line pull of 50,000 pounds for hoisting and 100,000 pounds for towing. Other advantages of the hydrostatic transmission in this application are: one operator control, the overload protection inherent in the system due to the relief valve, and the ability to apply or release the mechanical brake using a cylinder and hydraulic power, Figure 1.

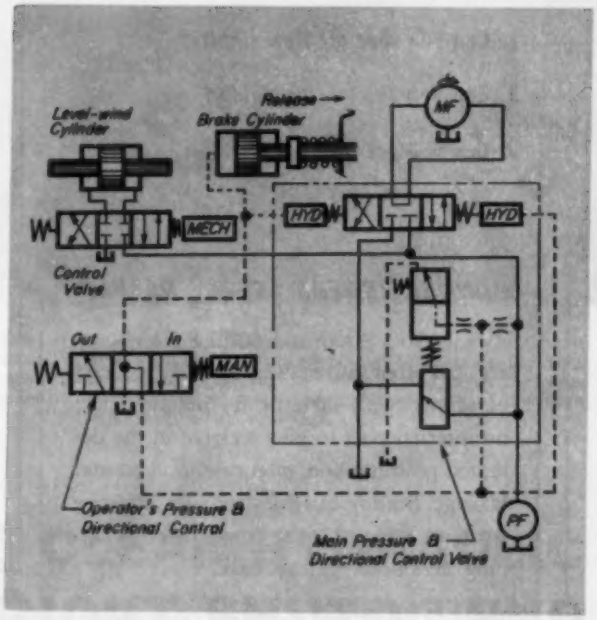


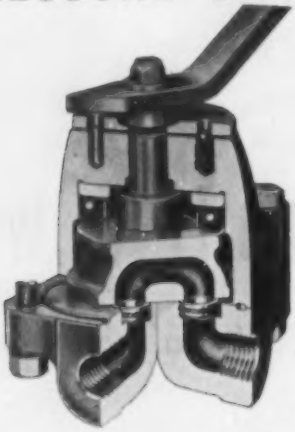
Fig. 1—Circuit diagram of the winch-drive hydraulic transmission. Brake is automatically applied or released during appropriate portions of the operating cycle to simplify operator control to a single lever. Brake is fail-safe type requiring that pressure be applied to release the brake. The two relief valves shown represent a spool in the main valve which unloads the pump directly to tank when the pilot valve is in the centered or *off* position.

• **Level Wind**—Selection of hydraulic power for the winch proved to be an even wiser selection than was first realized when a newer version of the vehicle was designed. One of the required modifications was that the winch be repositioned as close to the end of the vehicle as was consistent with protection requirements. This meant that a fair lead could no longer be used for level winding of the cable. Without a level wind, cable life would have been ridiculously short.

Investigation of this problem disclosed that there

ROBERT J. SCHRADER, *Hydraulic Engineer*, JOSEPH F. WEINUM, *Project Engineer, Bowen-McLaughlin-York, Inc., York, Pa.*

DO YOU **CONTROL** YOUR HI-PRESSURE CIRCUITS?



1. Can you shut off flow tightly?

2. Can you throttle gradually?

3. Can you get full flow?

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are leakproof and stay leakproof for years of service with little or no maintenance; no internal port to port leakage in the detented positions and, of course, no external leakage. Sealing qualities actually improve with use, due to wear compensating lapping action of "Shear-Seals."

2 You get excellent throttling, smooth action to any degree of flow without fighting the fluid pressure.

3 Quick as a quarter turn of the handle you can open the full flow (or shut it off) with surge dampening action, because the round tubular passages have no spools or poppets obstructing flow.

BARKSDALE VALVES

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is no commercially available level-wind unit with the required capacity and that a mechanical unit designed along the lines of existing units would require so much power for its operation that a separate power source would have to be provided or the winch drive motor would have to be increased in size to supply the additional power.

An investigation of the use of hydraulic power used in conjunction with a double-ended cylinder arrangement showed that the maximum power demand is less than 2 hp. This is available from the existing pump. Operating cycle of the winch is such that adequate flow was available.

Requirement for the level wind is that it drive against a 50,000 pound side thrust developed when the full line pull of the winch is exerted at 30

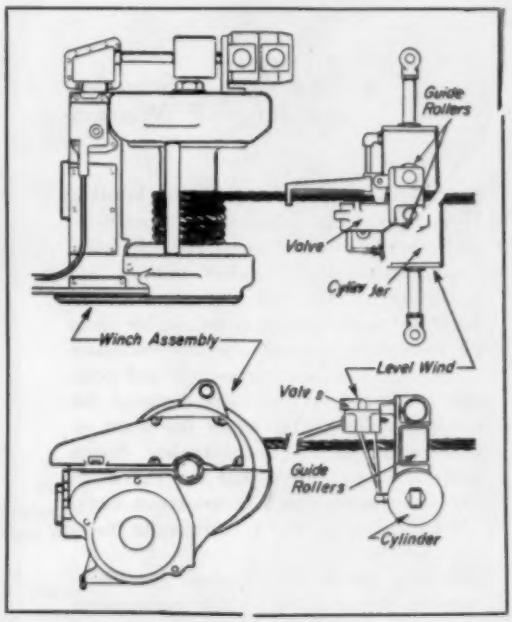
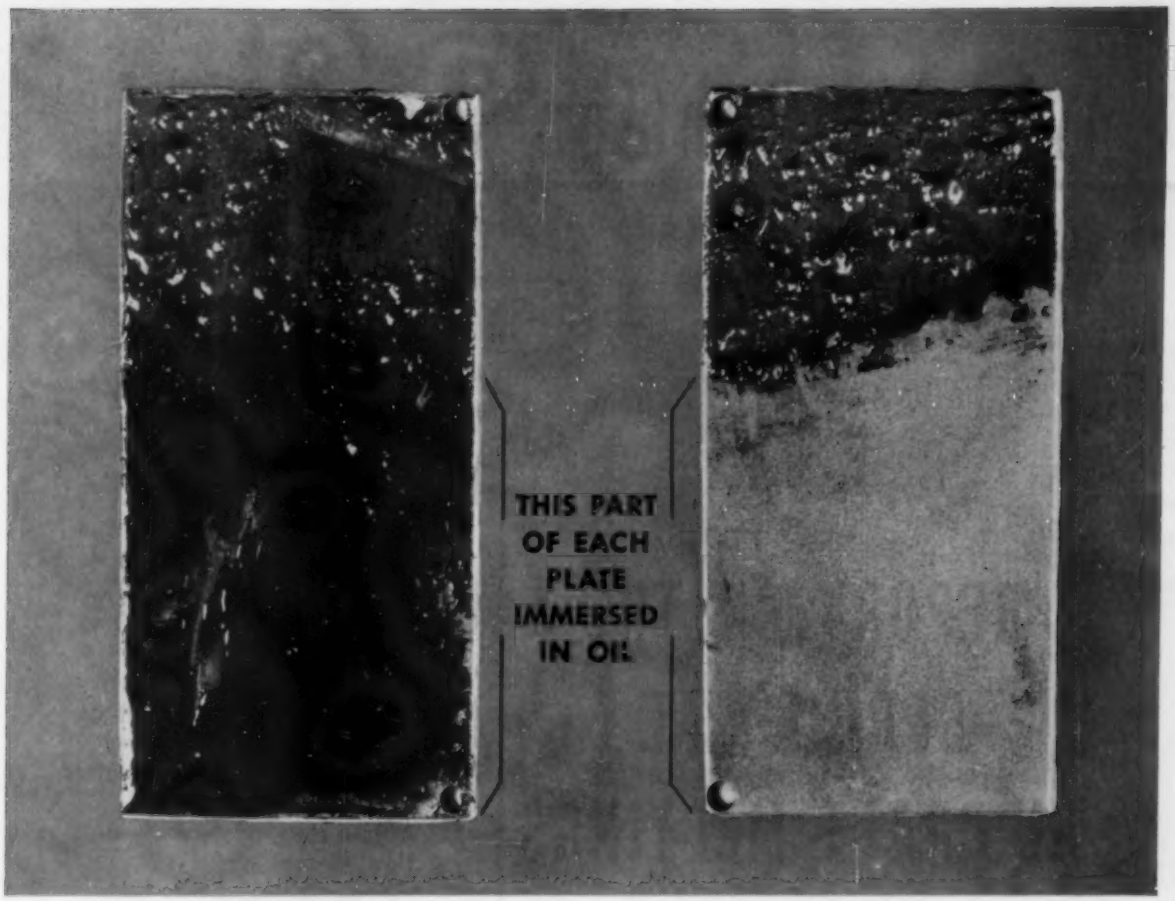


Fig. 2. Level wind is a dor ible-ended cylinder on which control valve and guide rollers are mounted. Both rod ends are anchored, and the cylinder body moves to guide the cable back and forth across the drum.

degrees from the ce nterline of the winch while moving 10.23 inches per minute. This provides for a line speed of 30 fpm.

The level-wind de vice designed to meet these requirements is a d ouble-rod cylinder with both rod ends anchored. G uide rollers for the cable are mounted on the cyli nder. The control valve which reverses cylinder mo vement to move the cable back and forth across the drum is also mounted on the cylinder. This arran gement is shown in Figure 2.

Level wind mover ent is limited to 3/4 in. less than the drum widt h. The double-ended cylinder is 7 in. in diameter and has a 2 1/2 in. diameter rod. Operating press ure is 2000 psi. ▼▼▼



This sludge-coated metal plate was partially immersed in a beaker containing a *regular hydraulic oil* heated to normal operating temperature. Though the oil was agitated throughout the test, nearly all the sludge remained on the plate.

This similarly sludge-coated plate was partly immersed in a SUNVIS 700 oil, also heated to normal operating temperature. During the same period, with the same degree of oil agitation, the immersed part of the plate was rinsed clean of sludge.

Simple test shows how

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REPORT ON THE SPRING SAE AIRCRAFT MEETINGS

Aircraft hydraulic and pneumatic system designers, manufacturers of components, and the military services have a common meeting ground in the SAE aeronautical committees. Twice a year, spring and fall, they gather to discuss common problems and solutions. Here are some of the highlights of the meeting held in Boston early in May.

FITTINGS

Proper tightening torques for MS fittings are still being studied in an attempt to find a universally satisfactory procedure. Presently used methods vary from company to company. It was agreed that the matter should be studied and tests made to arrive at a good workable method.

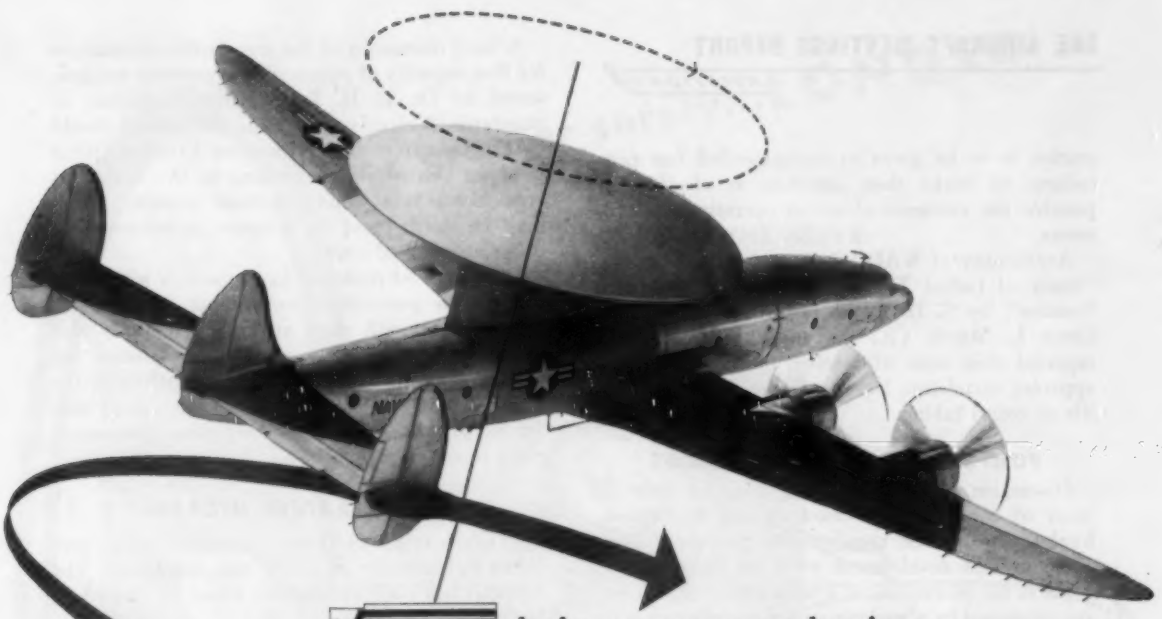
Work is being done on protective coatings as well as materials and proper material combinations to prevent fitting failures due to corrosion and high and low temperatures. Parker Aircraft reported results of a study of low-temperature properties of Titanium indicated a need for the inclusion of both aluminum and vanadium as alloying elements for service at —65 F while providing high ultimate tensile strength at temperatures to 800 F.

Formation of a new subcommittee, AE-3 was announced. To be known as the fluid connection and design group, the new subcommittee will have members from various other SAE subcommittees. First meeting was to be held in Washington, D. C. in May.

HOSE

Results of tests on a proposed standard hose-end fitting for use with MS standard flareless adapters were discussed. Announced results were that the proposed design successfully passed tightening torque, pressure and temperature required without malfunction. All samples also passed impulse and vibration tests with no leakage or other malfunction. To obtain further test results for substantiating purposes, drawings of the design have been made available to other manufacturers. It was pointed out by the sponsor that the proposed design is one piece and cannot therefore, be incorrectly installed. Also, the design is such that it cannot be used inadvertently with AN fittings.

A tentative specification for Teflon high-pressure hose was presented and discussed. Further consid-



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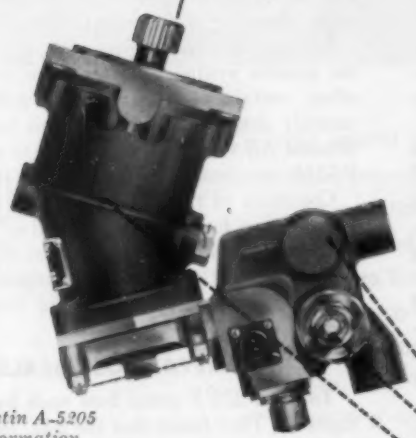
by turning 3 tons with 13 pounds

The giant "saucer", rotating atop this Lockheed Super Constellation, contains an airborne radar antenna. It requires a high-power-to-weight ratio driving mechanism for the scanning operation. This mechanism must be compact, dependable, able to provide constant speed, regardless of load change . . . and operate in a position remote from the aircraft power supply.

The small (approximately 13 pounds) VICKERS PACKAGE DRIVE more than meets the drive requirements of the large (30 feet diameter) radome. And – like similar Vickers hydraulic components used in the Constellation for other purposes – provides proven dependability spanning many years of aircraft applications.



Drive components include:

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- Slide valve for selection of motor rotation direction and speed.
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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

eration is to be given to recommended test procedures to make them simulate as closely as possible the extremes of actual operating requirements.

Availability of WADC Technical Report 55-121, "Study of Coiled Tubing For Aircraft Hydraulic Systems", by C. H. Cooke and R. D. Stauffer of Glenn L. Martin Co., was mentioned. Lockheed reported their tests with coiled tubing showed no apparent correlation between flattening and fatigue life of coiled tubing.

PUMPS, MOTORS, COMPRESSORS

Discussion of the work being done on development of components to meet coming high-speed, high-temperature requirements produced some opinions that development work on these components is not proceeding at a satisfactory pace. Feeling expressed by a spokesman for manufacturers of these components was that this might be true. However, he also expressed the opinion that the manufacturers are doing as well as they can with relatively limited funds at their disposal. The suggestion was made that perhaps more aircraft and missile development funds should be allocated for this purpose.

PNEUMATICS

Bureau of Aeronautics reported that a pneumatic pressure switch specification, MIL-S-19893 has been issued. A discussion of MIL-R-8573, for glass fiber air reservoirs led to a decision to eliminate the present flattening test requirement.

A report on suitability of existing specifications for application to 5000-psi pneumatic systems stated that many may be used as-is and others will be suitable with minor modifications. A recommendation was then made that any existing spec coming up for revision be changed as necessary to cover 5000 psi systems. It was agreed that an Aeronautical Information Report listing all applicable specifications would be issued.

Grumman Aircraft reported the results of survey A6-121 on a proposed pneumatic cylinder specification. Question on the survey which produced quite a bit of discussion had to do with the necessity or advisability of requiring that samples be made up using tolerance extremes to prove that cylinders would work even when tolerance combinations were most adverse. Differences of opinion on this point definitely exist. It was agreed that this particular requirement would be made optional so the procuring agency might or might not require it. It was further agreed that to facilitate meeting this requirement one of the relatively moving parts required might be outside the actual tolerance range. This would permit a sample incorporating the required tolerance spread to be made up without meeting the actual extreme tolerances.

A brief discussion of the area factor calculations for flow capacity of pneumatic components was presented by Dr. D. H. Tsai, National Bureau of Standards. A circular describing the method should be available from the Government Printing Office in about two months, according to Dr. Tsai. The area factor is a nondimensional quantity which may be easily used to compare components of differing nominal sizes.

Discussion of problems in connection with high-temperature pneumatics brought out the need for packings that will work at 275 F. Work is also being done to evaluate pneumatic greases for service at this temperature. Representatives of the military services suggested it might be a good idea for industry to set up a high-temperature pneumatic panel to consider the various problems in this field.

HIGH-TEMPERATURE HYDRAULICS

Availability of an O-ring compound which performs satisfactorily at 275 F was announced. The material has been successfully tested in aircraft at Eglin Field test hangar.

Wright Field reported on their tests of O-rings bearing a color dot identification code. Their findings indicate a definite life reduction by comparison with unmarked rings. Life decreases as the number of color dots increases. Despite this, representatives of the O-ring manufacturers insist that this identification coding is necessary because of the wide variety of compounds now being used. Only one dot will, therefore, be used to give longest possible life while providing the necessary identification.

One O-ring manufacturer pointed out that despite the quarter system of O-ring age control now in effect, certain customers were still insisting on monthly dating. It seems that this has come about because ANA Bulletin 427 conflicts with the MIL-P-5516 specification.

Chairman of the panel revising the MIL-P-5514 specification for packing installation and gland design requested help on clarification of this specification. Particularly wanted are suggestions on clarifications of the tables to make them simpler to use.

METAL BOSS SEALS

Tests on 275 F metal boss seals by WADC were reported. They found that the SAE 1020 steel being used does not have sufficient corrosion resistance at this temperature. Type 303 stainless steel has also been tested and does not withstand thermal cycling. Various combinations of other materials are now being tested to find a satisfactory answer. According to the WADC representative, two-piece seals are better than the three-piece type.

Tests on a new seal developed by Parker were described as very encouraging. The seal is labelled a "wing" seal. Successful tests have been run over the Type II range of —65 to 275 F. Test pressures of 3000 psi were used with impulses to 4500 psi.

North American Aviation reported that spiral teflon backup rings are being severely damaged

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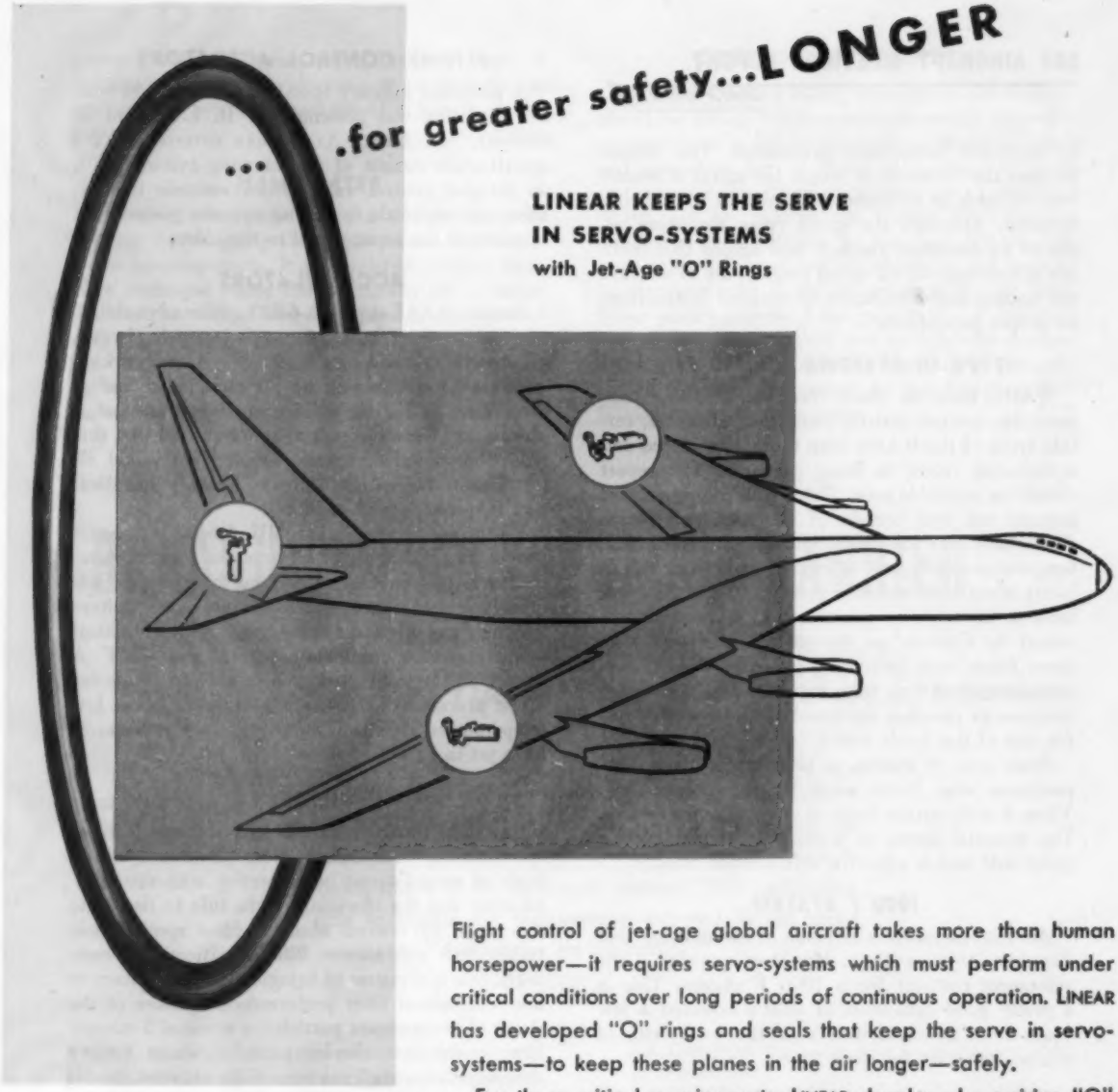

Flight control of jet-age global aircraft takes more than human horsepower—it requires servo-systems which must perform under critical conditions over long periods of continuous operation. LINEAR has developed "O" rings and seals that keep the serve in servo-systems—to keep these planes in the air longer—safely.

For these critical requirements, LINEAR developed precision "O" rings molded of the newest elastomers to meet the most rigid specifications. They will withstand temperatures of from −130° to 550°F —give long service life under severe mechanical abuse—and will withstand the destructive action of such fluids as silicate and phosphate esters, hydrocarbons and synthetic lubricants.

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by improper installation procedures. This occurs because the direction in which the spiral is wound may be such as to cause it to unwind when being installed. Although the spiral rings are being replaced by one-piece rings, it was agreed that there are still enough of the spiral rings in use to warrant the issuing and circulation of detailed instructions on proper procedures.

TYPE III SYSTEMS (to 400 F)

WADC tests on fluids for use at these temperatures are not entirely completed. However, certain types of fluids have been thoroughly tested and a technical report is being prepared. The report should be available soon. The WADC representative pointed out that certain of the high-temperature fluids have very low hydrolytic stability at elevated temperatures and can be ruined in as little as 23 hours when ½% water is present. Precautions will have to be taken to prevent this. A question was raised by Convair on the change in viscosity of these fluids with increasing pressure. WADC representative said their tests showed a 100% viscosity increase as pressure increased from 0 to 4000 psi for one of the fluids tested.

Seals are, of course, a problem at these temperatures also. Some work has been done with Viton A with certain fluids at elevated temperatures. The material seems to withstand thermal cycling quite well and is effective with certain fluids.

1000 F SYSTEM

An announcement was made at the meeting that Republic Aviation Corp. has been awarded a development contract for a 1000 F system. This is a pretty good indication of what's expected a few years from now. All details of the work will, of course, be secret for some time.

SERVO VALVES

An SAE Aeronautical Recommended Practice for classification, definition and testing of servo valves has been under preparation for some time now. The Autonetics member of the committee reported that considerable revision has been going on, based upon suggestions of the interested parties. The revised version should be ready for circulation now.

PRESSURE DROPS

A proposed draft of ARP 24 A, Aeronautical Recommended Practice for the Determination of Hydraulic Pressure Drop, was circulated at the meeting. Unless there were objections raised, this was to be accepted by June 1. This ARP contains a theoretical discussion of the factors involved, recommended methods for determining pressure drops experimentally, rated flow tables for various tube sizes and pressure drop charts.

FLIGHT CONTROL ACTUATORS

A proposed military specification for flight control actuators was presented by H. E. Wright of Convair, San Diego. Actuators covered by the specification consist of an actuating cylinder with an integral control valve which controls the relative motion of the actuating cylinder piston as a function of the input signal to the valve.

ACCUMULATORS

Results of SAE survey A-6-123 on the advisability of reducing the required burst pressures for hydropneumatic accumulators to 2.5 times the working pressure showed voting by 26 airframe manufactures was 20 for the reduction, 5 against and 1 abstaining. General opinion seemed to be that this reduction in burst pressure requirement would allow a desirable weight decrease. Military specification involved is MIL-A-5498.

Proposed revisions of MIL-A-5498 to assure proper functioning of accumulators at low temperatures was another subject on the agenda. Failures have been encountered because accumualtors lost their gas precharge at low temperatures. Critical temperature for accumulators tested was —35F. A survey on the subject resulted in a 17 to 3 vote for a test procedure to assure proper operation at low temperatures. Details of the required test procedures have yet to be agreed upon.

FILTERS

Revisions to proposed 2-5 micron Type II filter specification, MIL-F-8815 were discussed. Seemingly of most interest in connection with this specification was the changing of the title to designate this as a 15 micron absolute filter specification rather than a 5 micron filter specification. Seemingly, this is a matter of bringing the designation in line with actual filter performance. Because of the shape of contaminant particles, a nominal 5 micron filter could pass slender particles whose longest dimension exceeds 5 microns if the shortest dimension were less than 5 microns. As the revised specification is written, 100% of particles having any dimension larger than 15 microns will be removed. A request was made at the meeting that every effort be made to acquaint people concerned with filter purchases of this. When the filter manufacturers were asked whether or not filters were available to meet the specification, they admitted that there were not, at the moment. However, they expect there will be very soon.

RELIEF VALVES

The problem of hydraulic system failures due to relief valve pressure settings varying with change in temperature was discussed. A suggestion that perhaps MIL-V-5523 should be changed to specify a higher minimum reseat pressure was made. However, general opinion seemed to be that use of proper material for the relief valve spring would

prevent this by keeping relief pressure where it belonged rather than allowing it to decrease as temperature increased because of a loss in spring tension.

NAMEPLATES

A request was made that the services consider revising or dropping the requirements for nameplates on components. It was pointed out that there were instances where the provisions for a nameplate are such as to add an appreciable amount of weight to a component. It certainly seems that in the case of extremely small components, it may well be that the bosses for attachment and the nameplate itself may increase weight considerably.

CORROSION PREVENTION

Convair, Pomona asked whether or not requirements for filling certain components with corrosion preventive oil could be changed to permit a standard procedure for all types of systems. In some instances the specification permits use of the fluid which will be used in the system. This is considered to be preferable by Convair. WADC representative indicated that the matter would have to be discussed with materials people at Wright field. Other parties expressed the opinion that a preferred approach to the problem was to fabricate components from corrosion resistant materials or use protective finishes as required by the Navy so that filling would be unnecessary. ▼▼▼

BREAKING THE THERMAL BARRIER

. . . report of Turbojet Engine Hydraulic Symposium

Will production of pilotless aircraft be greater than manned planes by 1960? How will this cross-over affect the application of hydraulics? What new performance demands are being made of the hydraulic system? Will hydraulics be able to hurdle the temperature barrier? What about the commercial market for jet aircraft?

MORE than 100 engineers working with jet engine design programs met in Detroit the last week of April for the 1957 Turbojet Engine Hydraulics Symposium sponsored by Vickers, Inc. Here are the highlights from the discussions and eleven papers given at this two way meeting.

• **Crystal ball**—Vickers' chief of research, Gerhard Reethof wiped the oil film from his crystal ball and looked into the future of fluid power controls in jet engines. Here's what he sees:

a) Operation at 700F and higher

b) An environment of intense radiation resulting from an adjacent nuclear reactor

c) Smaller space—greater demands for efficiency

Here are the operations where fluid power controls are or may be used in jet engine operation:

1. Control of the inlet guide vanes into the compressor
2. Control of the compressor stator blades
3. Control of the nozzle area by an iris or other means
4. Control of fuel pump drives either by constant speed or controlled speed drives
5. Lubrication pump drives
6. Constant speed alternator drives
7. Jet engine starter systems

Lubricity at high temperature is a major problem confronting the designers of fluid power components. Fluid properties at high temperatures must be studied—hot gases and heavy liquids such as mercury as well as petroleum base and synthetic hydraulic liquids.

It has been found that the bulk modulus of synthetic hydraulic fluids drops very sharply with increase in temperature so that the incompressibility feature no longer applies. This makes the investigation of hot gases as a power medium more attractive. It's been found that high pressure, high temperature gas servos can be designed to have very high speeds of response.

Using presently available hydraulic fluids operation at 550F appears promising—it requires careful selection of material combinations and design changes.

• **Hydrokinetic devices**—Centrifugal pumps and pitot type pumps offer promise. These units have a minimum of closely fitted sliding surfaces. Face type seals to operate at 700F are available. A high density, low viscosity fluid such as mercury might be used. It's extremely incompressible.

COMPONENT DEVELOPMENT

New experimental and development work undertaken during the past year was covered by Frank Moncher and Ken Postel of Vickers. Major emphasis is on improvement of reliability through design modifications, new materials and rigid quality control.

• **More speed and pressure**—Continuous duty speed ratings have been increased 11%; extended duty speed ratings have been increased 100%. A pump is under development to have a design life of 1000 hours at 4000 psi pressure. Another in development is a variable delivery 5000 psi, 3600 rpm unit.

• **Dirty oil**—More than 200 contamination tolerant pumps are now in the field. These units are designed to give satisfactory life with a fluid filtered to the 40 micron level.

• **Clean pump design**—Objective of this program is to have a pump which generates minimum contamination due to normal wear. Special bearings improved washing, assembly and test techniques are the keys to this design.

• **Miniature pumps**—Small piston pumps delivering 3.5 hp per pound have been built. Typical specs are 90% overall efficiency at 3000 psi and 10,000 rpm. Extension of operating speeds to 25,000 rpm is planned. Under development is a ¾ pound vane pump—1000 psi, 10,000 rpm.

EXHAUST NOZZLE CONTROL SYSTEMS

A newly developed load sensitive system for nozzle actuation on small engines where size and weight are important was described by Don Moses and H. C. Bujak of Vickers. The system combines the advantages of both the servo pump and servo valve and takes advantage of the varying engine load characteristics. This decreases the size of hydraulic components. The flexibility of the system permits it to be either constructed in a single package or left as individual components. Since the circuit is relatively simple, and components are of a standard qualified design, the reliability of the system is reported to be high.

Basic principle of the system is to maintain a small constant pressure drop across a directional valve at all times and to let the overall system pressure vary with the load. The load characteristic of a nozzle usually requires a high maximum load for a small portion of the engine life and relatively low load for a majority of the engine life. A constant pressure system is penalized by this characteristic and requires a system designed about the maximum load level. The load sensitive system permits designing for a high intermittent pressure for the short lift maximum load conditions.

COMBINING LUBE AND HYDRAULIC SYSTEMS

Don Uehling of General Electric's jet engine department discussed the advantages and disadvantages of combining the engine hydraulic and lube system. An integrated system offers less total engine weight, conservation of installation space, less plumbing, simplified installation problems, and favorable factors in the area of logistics. Separate systems offer the possibility of improved reliability and performance of hydraulic system components, allows the designer more flexibility in planning and tends to reduce the hydraulic system heat load. Which is better? Uehling said, "The answer today is that the engine hydraulic system may be profitably integrated with the engine lube system. Tomorrow, as flight speeds increase and are accompanied by exponential increase in temperatures, the separate hydraulic system offers increasing advantages".

FUEL CONTROL TEST STAND

Development of new fuel control calibrating methods and equipment has not been nearly as rapid as the development of the jet engine and its control system. J. Bigus and R. Egge of Vickers described the development and use of a test stand to do dynamic and static testing of turbo-jet fuel controls. Their work has shown that dynamic testing of J-34 fuel controls on a production basis is practical. Much work remains to be done in the field of developing test techniques using dynamic methods.

HIGH TEMPERATURE FLUIDS

Diester fluids of the Spec. MIL-L-7808 and MIL-L-6387 types have had 5 to 7 years of successful application as hydraulic fluids and lubricants. These materials exhibit substantial improvement over their mineral oil counterparts Spec MIL-O-5606 and MIL-O-6081 in terms of volatility properties. The excellent lubricity properties of the ester type fluids persist to temperatures of at least 500F and these fluids show good response to lubricity additives. Also these ester fluids have good thermal stability and low corrosion up to about 500F. In a closed hydraulic system, or one having limited access to air, current research indicates that these ester fluids should provide satisfactory operation up to about 500F. The useful life of these fluids will be dictated primarily by the time at the highest temperature. Dr. E. E. Klaus and M. Fenske, Petroleum Refining Lab, Penn State University reported on these diesters as high temperature hydraulic fluids. ▼▼▼

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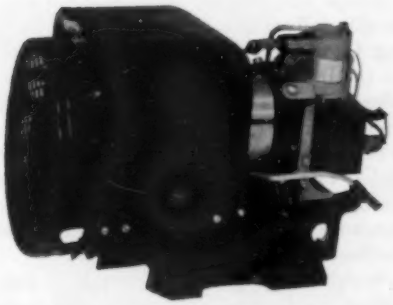

Another off-the-shelf item – Kidde 2 cfm AC-driven compressor package including moisture separator, relief valve, pressure switch and inlet pressure regulating device.

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Matching the smoothness of her Rolls-Royce prop jet engines, pneumatic power for the F-27 is furnished by two engine gear box driven Kidde 2 cfm air compressors. The air stored at 3300 psi is used for operation of nose wheel steering, wheel brakes and anti-skid system, landing gear, up locks, propeller brakes, tail bumper and emergency systems.

Design responsibility for the F-27 pneumatic system rests with Walter Kidde & Company, who can furnish complete pneumatic systems on an off-the-shelf basis, as well as the engineering talent to develop and produce special equipment on request. Get the answers to your pneumatics problems now ... by writing Kidde today.

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Conversion for production as a maritime reconnaisance aircraft of the Bristol Britannia transport dictated some interesting modifications of the hydraulic system. Designated CL-28, the search craft incorporates virtually a whole new fuselage as well as piston engines rather than the turbo-prop power plants of the Brittania to give increased operating range at low search speeds.

Converting a Transport Requires Hydraulic Changes

• **Pressure Decreased**—An all—encompassing modification resulted from the decision to use a 3000 psi system rather than the 4000 psi system with which the Brittania was originally designed. This modification was dictated by the availability of components for service at 3000 psi. Canadair designers felt that availability far out-weighed the 21 lb weight increase which seemed to be necessary. Further changes eliminated this weight differential.

• **Main Power System**—In the Brittania, main source of hydraulic power consisted of four electric motor-driven pumps weighing 28 lb each. By incorporation of a speed-reduction gear train and mounting pad on the constant speed alternator drive of the CL-28 it was possible to substitute two directly driven pumps weighing 6.7 lb each. Operating times were still well within specifications.

• **Landing Gear Redesign**—Although operating pressure of the Brittania is 4000 psi, a pressure reducing valve was used in the nose wheel steering system to reduce pressure to 2000 psi. This was considered to be necessary for smooth steering circuit characteristics. Full system pressure of 3000 psi is used on the CL-28. To maintain equal steering force a smaller cylinder is used. This change produced a weight saving of 9.6 lb.

• **Brake System Changes**—Wheel brake system of the CL-28 shows considerable modification, both to save weight and increase reliability in the event of battle damage. Brittania brake is a dual-piston type in which both main and emergency fluid are supplied by separate lines simultaneously. However, both brake systems were supplied by a common quadruple valve. In the CL-28, main and emergency valves are separate. Emergency supply is ordinarily shut off by a solenoid valve. A similar valve in the main system allows it to be shut off if damaged. Operation of the *Emergency Brake* switch by the pilot shuts off supply to the main system, opens the emergency system valve and starts an emergency motor-driven pump. This provides unlimited emer-

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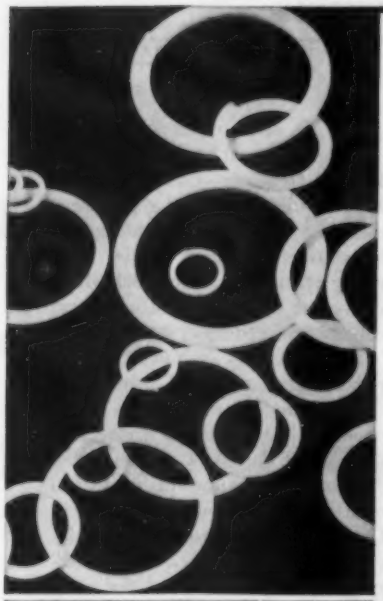

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- **Design of system components** including actuators, valves, pumps, accumulators, transmission lines and seals is discussed.
- **Hydraulic servo systems** are diagrammed and the transfer functions developed. Fundamentals of transient analysis technique and frequency response method of servo testing are given. The chapter on high temperature hydraulics outlines present progress in fluids, seals, springs, metals, and other critical components, and indicates future developments.

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gency-braking capacity. In addition, an accumulator will supply fluid for eight normal brake operations.

• **Aileron Lock Modification**—Control surface locks required when the aircraft is tied down were originally fully hydraulic and were, therefore, only as positive as the system. In other words, fluid leakage in the locking cylinders reduced lock effectiveness. Also, this system did not allow a ground checkout of control system freedom of movement to be made. Both of these objections were overcome by incorporating hydraulically operated mechanical locks and spring loading the control surfaces in the *down* position. Since the locks held the surfaces in the *up* position, release of the locks permitted the spring to move the surface from the full *up* to full *down* position, to check free motion.

• **Bomb Bay Door System**—Probably the biggest modification from Brittania design is the addition of bomb bays both fore and aft of the wing and the hydraulics necessary for their operation. Integral-lock-type cylinders are installed at the forward end of each door. Both main and emergency actuating system are provided and operate simultaneously. A selector switch allows actuation of valves for either or both sets of doors. Both main and emergency system components are mounted so as to be be easily accessible for maintenance. ▼▼▼

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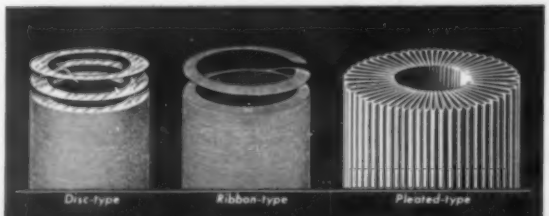

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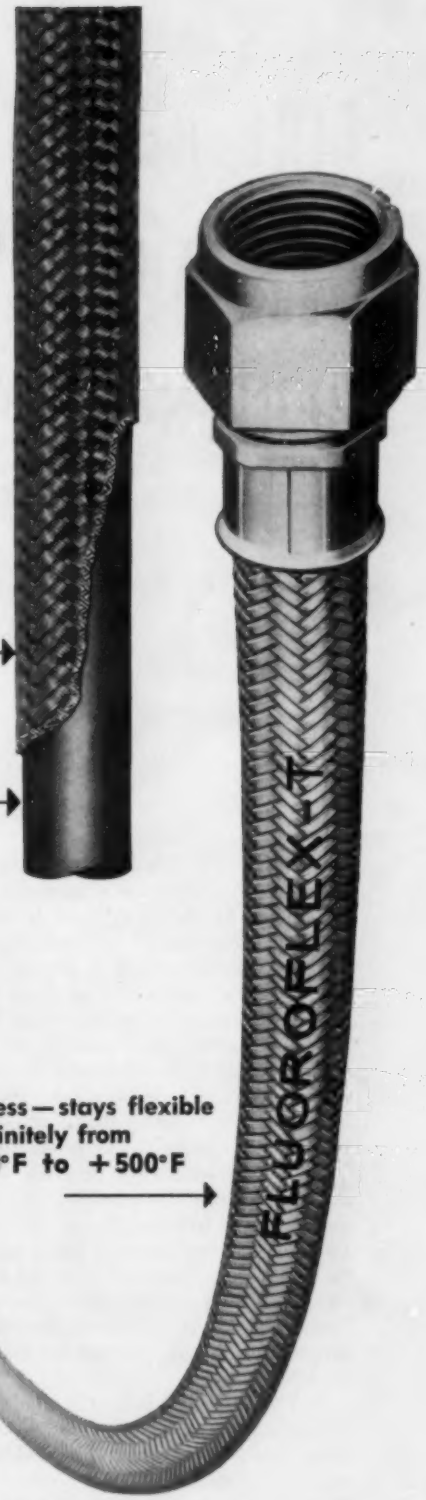

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FIRE-RESISTANT HYDRAULIC FLUIDS

PART 2 — Aqueous Base Types

• By W. H. Millett

DEVELOPING fire-resistant hydraulic fluids around the well-known inertness of water was undertaken by the U. S. Navy in their search for less flammable aircraft hydraulic fluids. Naval Research Laboratory did the original work with the cooperation of industry. This work has been thoroughly discussed in the technical literature. The term "hydrolube" was coined by the Navy as being descriptive of fluid lubricants containing substantial quantities of water as a base. Thus "hydrolube" is a generic term rather than a trade name and can be correctly applied to any product of this type.

In 1946 a laboratory program was initiated to adapt the fluids developed for aircraft to the requirements of industry. It was necessary to develop fluids with higher viscosity that could be used satisfactorily under the continuous operating conditions employed in a modern plant. Such fluids would have to be rugged and would have to compete performance-wise with conventional petroleum hydraulic oils.

In 1947, the first industrial, hydrolube-type, fire-resistant hydraulic fluids were marketed. Since that time they have become well established and have spread to a host of industries where the use of less flammable hydraulic fluids is a paramount safety consideration.

W. H. MILLETT, *Carbide and Carbon Chemicals Company, Division of Union Carbide and Carbon Corporation, New York, N. Y.*

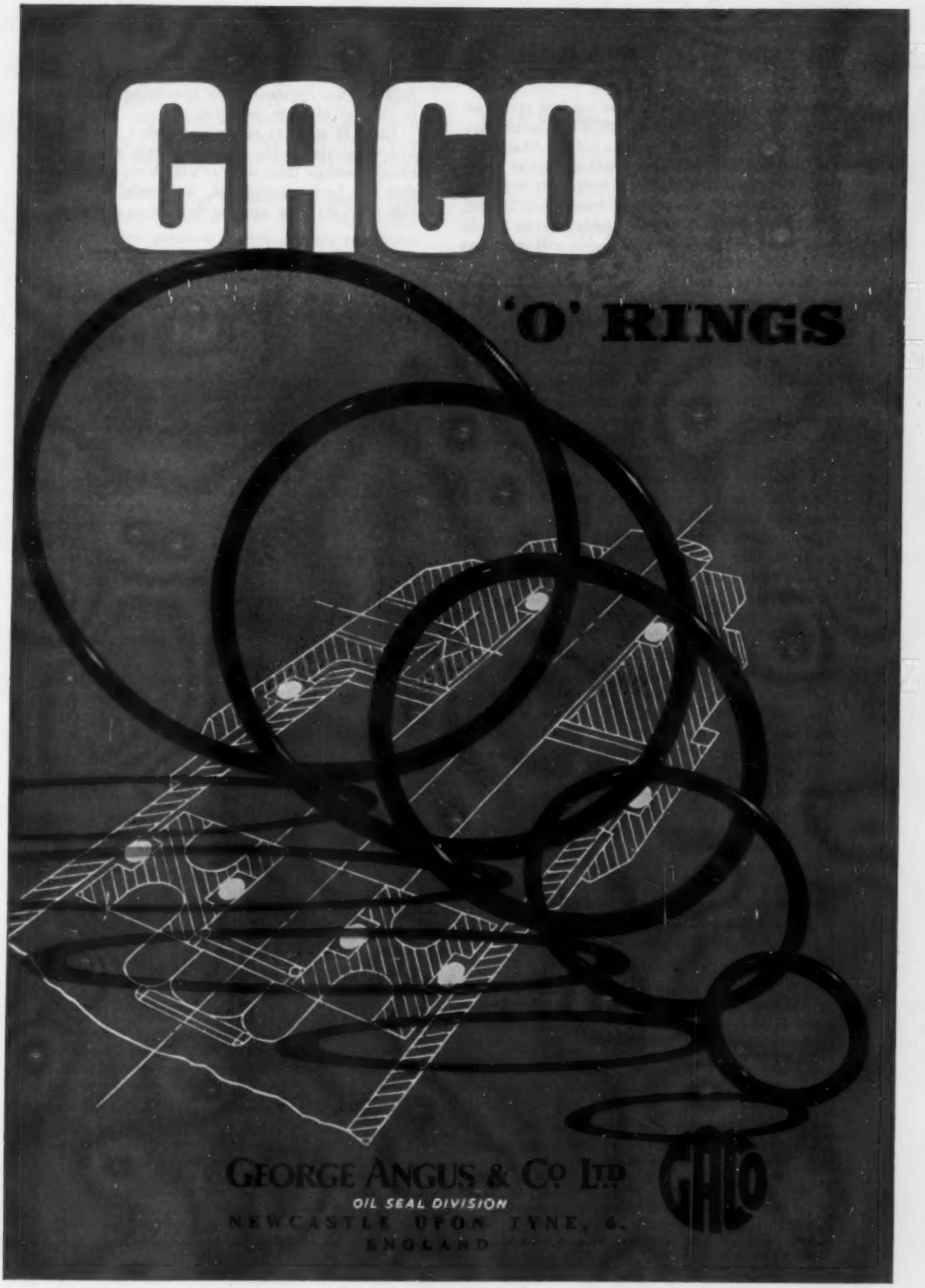
PROPERTIES OF AQUEOUS SAFETY FLUIDS

Before aqueous, fire-resistant fluids can be used successfully, the user must be familiar with what they are and how they differ from conventional hydraulic oils. These fluids consist essentially of from 35 to 60 percent water for non-flammability, a glycol, and a water-soluble thickener and lubricant to give body or viscosity to the fluid. In addition, the fluid will contain carefully selected additives that impart corrosion preventive properties as well as anti-wear and lubricity characteristics to the finished product. Thus, it can be seen that the final fluid is a carefully balanced formulation designed to meet the exacting requirements of modern industrial usage.

Certain properties and performance characteristics of these fluids are of particular interest to the industrial user.

• **Fire-resistance** of aqueous-base fluids depends on the water content, and they are considered to be essentially nonflammable as long as the water content is maintained. When the water is allowed to boil away or to evaporate by prolonged exposure to elevated temperatures, the residual fluid will burn when ignited. Experience indicates, however, that the major industrial fire hazards involve ignition of sprays or mists of flammable fluids when lines break and packings or seals fail.

The resistance of the water-base fluids to burning has been evaluated by several methods including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incendiary gunfire, spontaneous gunfire, spontaneous ignition, hot exhaust manifold and spray flammability tests. All of these tests indicate that aqueous-base fluids as formulated will not ignite under the same conditions that will invariably result in "flash" fires with petroleum hydraulic oils. In fact, it has been demonstrated that under certain conditions aqueous-base hydraulic fluids will act effectively as fire extinguishing agents.

• **Viscosity** or body is imparted to aqueous fluids by the incorporation of a water-soluble thickening agent. This means that the viscosity of the finished product can be varied by adjusting the quantity of the thickener in the finished formulation. Thus, it is possible to select a fluid having the proper viscosity for the mechanical equipment involved. Representative viscosity characteristics are shown in Table I and are compared with typical viscosity values for a medium-grade petroleum hydraulic oil. A comparison of the low temperature viscosities of these fluids shows that the aqueous fluids have significantly lower viscosities at low temperatures than do conventional petroleum oils of comparable viscosity at 100 F, Table I.

• **Corrosion protection** is a most important consideration for any water-base product. Both laboratory and extensive industrial experience have shown that aqueous hydraulic fluids can be safely used in conjunction with the common materials of construction such as steel, aluminum, brass, or copper under normal operating conditions. Although fluids of this type cannot always be evaluated by conventional test procedures, it is of interest that water-base hydraulic fluids successfully pass the standard ASTM test for rust preventive characteristics (ASTM Desig. 665-53T).

• **Seals and packings** encountered in the hydraulic systems of die casting machines have generally shown no deleterious effects from aqueous base fluids. For this reason, no special seals or packings are required when converting equipment to the use of these products.

Table II presents rubber swell data for typical hydrolube-type fluids under standard test conditions. Based on these data as well as the experience that has been accumulated, it is safe to assume that the use of the aqueous fluids does not present a seal problem. One exception to this general statement is the use of cork impregnated seals. Although such products have been used successfully in die casting systems with water-base fluids, it is believed to be preferable to replace them with a more conventional rubber seal.

• **Wear resistance** is an important point to consider before converting any system to aqueous hydraulic fluids. The greatest industrial experience with these fluids has been accumulated in hydraulic systems powered by vane-type pumps. Field service experience and laboratory test data combine to show that aqueous fluids can be used satisfactorily in such systems and that, with proper attention to hydraulic system maintenance, replacement of pump

---

. . . More on Fire-Resistant Fluids

This is the second of a series of basic articles on the different hydraulic fluids currently available.

The first article, published in April discussed Emulsion Fluids. Subsequent articles will be:

Phosphate Ester Base Fire-Resistant Hydraulic Fluids, by F. H. Langenfeld, Monsanto Chemical Co.

Steps To Take When Installing Fire-Safe Hydraulic Fluids, by Charles R. Schmitt, E. F. Houghton & Co.

Concluding article in this series will deal with the experience of a large die casting company.

Special Considerations that should be borne in mind prior to installing an aqueous fluid in a hydraulic system are inherent with such products and do not represent major problems as long as they are understood.

SOLVENTS EFFECT ON PAINTS:

All of the currently available aqueous-base fluids will soften or lift many of the conventional types of paints and coatings. It is, therefore, advisable to remove all paint from the inner surfaces of hydraulic equipment which may come in contact with the fluid unless it is definitely known that the paint will not be affected. There are available a number of resistant finishes.

VAPOR PRESSURE:

Because of their water content, aqueous-base hydraulic fluids are characterized by high vapor pressures at elevated temperatures. This may result in loss of water and, in some instances, loss of volatile inhibitors. For this reason, continued use of water-base fluids at temperatures in excess of 150 F is not recommended.

GREASE CONTAMINATION:

Conventional greases are not soluble or readily dispersible in aqueous fluids. Care should be taken to prevent overgreasing of parts in contact with the fluids, since this may result in accumulation of excess grease on filters or screens with resultant clogging.

ZINC AND CADMIUM:

Zinc and cadmium metals are frequently dissolved by aqueous fluids with resultant soap precipitation. The use of galvanized metal zinc or cadmium-coated parts should be avoided.

parts is not significantly higher than with standard petroleum oils.

Data presented in Table III give typical wear results as compared with those obtained using widely used petroleum hydraulic oils. Wear losses for all the fluids are considered to be acceptably low.

Experience in other types of pumps has been quite limited. In general, it can be stated that relatively low pressure systems appear to present no problem regardless of the type of pump used, but that high pressure systems may, in some instances, involve special considerations. Currently, considerable work is in progress to determine the suitability of various pump designs for aqueous-base hydraulic fluids.

INSTALLATION OF WATER-BASE FLUIDS

Proper installation of aqueous-base hydraulic fluids is probably the most important single consideration if they are to be used successfully. The system should be cleaned as thoroughly as possible prior to installation of the fluid. Ideally, this includes draining all oil from sump, lines, and cylinders and, in addition, removing any sludge or deposits that may have accumulated during previous service. It is realized that complete cleaning is not always feasible because of inaccessibility or mechanical limitations. In any case, as much oil as possible should be drained off and the system should be flushed and operated with a minimum quantity of the fluid that is to be used. The flush fill should be drained immediately after use so that suspended oil and sludge will be removed. The system should then be filled with fresh fluid.

During the early stages of operation, particular care should be paid to filters, since frequently the removal of sludge, oil residues and paint is incomplete. This can give rise to filter clogging and resultant pump starvation if filters are not watched carefully, and the elements replaced as needed. Undoubtedly, some petroleum oil will remain in the system. Small amounts of residual oil will not interfere with the performance of the aqueous fluids, but they do detract from flame resistance. Accordingly, it is advisable to remove them insofar as it is possible. Since petroleum oils are lighter than the aqueous fluids they will rise to the top of the sump and can be skimmed or siphoned off while the system is static.

To a large extent, the exact details of preparing a hydraulic system for fire-resistant fluids will depend on the available facilities and on the mechanical set-up that is involved. If a series of machines are to be converted, the same flush fill can be used for several. Steam cleaning has been found to be very effective where it can be easily utilized. The use of carbon tetrachloride or other chlorinated solvents should be avoided. Fuller's earth or activated clay type filters should not be used since they will tend to remove necessary additives from the fluid.

TABLE I

Typical Viscosities Aqueous-Base Hydraulic Fluids

	Viscosity, SUS 100° F.	0° F.
Fluid A	201	3,300
Fluid B	306	5,500
Fluid C	554	11,000
Medium Grade Petroleum Hydraulic Oil	250	18,000

TABLE II

Typical Rubber Swell Data for Aqueous Fire Resistant Hydraulic Fluid

Type of Rubber	Linear Swell, % (5 days at 158° F.)
Natural	1.0
Buna S	1.6
Buna N	3.5
Neoprene	1.1 — 2.0
Butyl	0.0 — 0.8
Silastic	0.0 — 2.0

TABLE III

Vane Pump Test Data

Test Conditions

Pressure	1000 psi
Duration of Test	750 hours
Fluid Temperature	150°F.
Speed	1200 rpm

Fluid Tested	Total Weight Loss of Pump Parts, Milligrams
Petroleum Oil A	909
Petroleum Oil B	242
Aqueous Fluid C	392
Aqueous Fluid D	330
Aqueous Fluid E	534
Aqueous Fluid F	85

The procedures and precautions that have been mentioned may appear to be unduly laborious. Actually, all of the indicated steps are in strict accordance with recommended hydraulic oil practices. The important considerations are that the system be cleaned initially and that it be maintained as clean as possible. The best answer to the successful use of aqueous-base hydraulic fluids has been good housekeeping and sound maintenance procedures.

CONTROL OF AQUEOUS FLUIDS

For optimum results it is advisable to subject aqueous-base hydraulic fluids to periodic control tests during use. Since the viscosity will increase if water evaporates from the fluid, viscosity is a convenient means of measuring the water content. Fluid suppliers will furnish charts or tables

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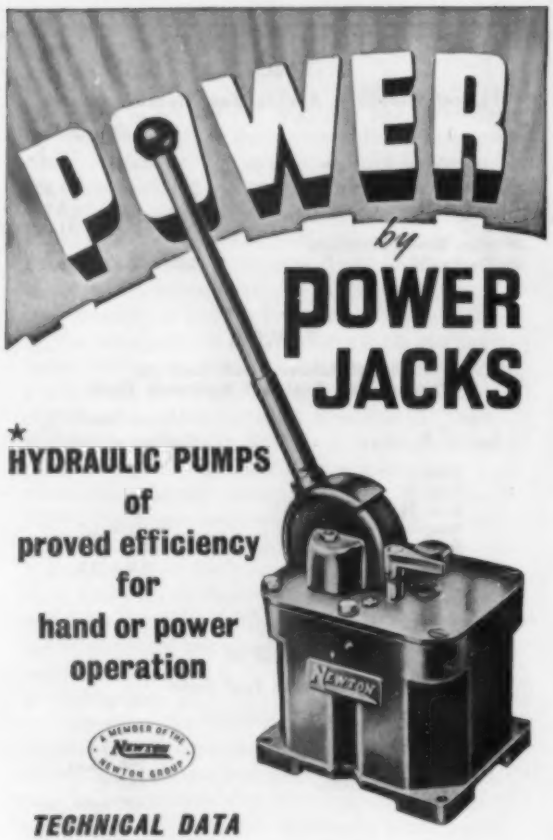

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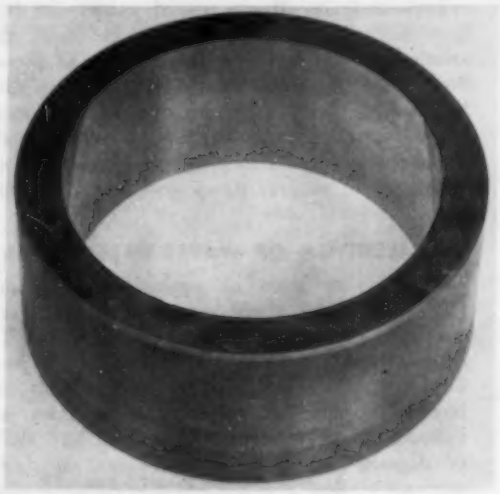
FIRE-RESISTANT HYDRAULIC FLUIDS

showing the amount of water to add for any given viscosity to restore the fluid to its original viscosity.

Only distilled, deionized or steam condensate water should be used for make-up, since hard water



ANTI-WEAR CHARACTERISTICS of synthetic fluids are shown by a vane pump ring after 1000 hours of operation.

may cause inhibitor precipitation. Normally, control tests are conducted at three or six month intervals. More frequent examination is sometimes recommended for the first few months of operation. Viscosity control has not been a serious problem or limitation in using aqueous-base hydraulic fluids. ▼▼▼

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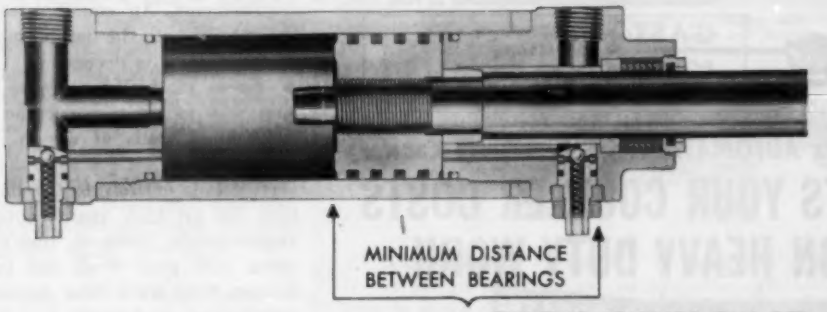

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JIC MEETS TO DISCUSS

To bring the JIC Electrical Standards up-to-date and to include technological developments since the last meeting in 1953, representatives of users, manufacturers, associations, publications, and military services met last March in Detroit. Ken Rexford, chief electrical engineer, Hydraulic Press Manufacturing reports the results of this meeting for AH readers.

TWO WORDS describe the problems facing the nearly 200 representatives to the conference—*clarification* and *understanding*. This is not because of ignorance on the part of the machine tool and electrical equipment builders. Nor is it caused by an unsatisfactory write-up of the JIC Standards. The JIC Committee has tried hard to correct problems in using and controlling electrically powered industrial equipment. They've been concerned with safety, uninterrupted production, long service life, and low-cost simple maintenance. A clear understanding is required by the builder of the user's requirements. An equally clear understanding by the user of both the design and economic problems of the builder is necessary.

• **Users vs. builders**—One controversial discussion was to what extent the user should go in specifying details of design. The users say they frequently do not get what they need if they leave such details entirely to the builder. In some cases they *did* get high quality jobs according to their requirements. However, they've had many experiences with poor work and poor engineering. Of course, they were most concerned about the unsatisfactory equipment.

The builders indicated that design features varied from one job to another, because of our competitive system, as well as the human element in design. They want adequate knowledge of such design, since it's a major part of their business. The economics of changing from standard design was also stressed.

Many builders would prefer to be given the machine requirements, and then be allowed to work out the details themselves. Detail design specifications from the user do not necessarily insure the required results, and it is difficult to *legislate* good design.

While not discussed openly at the conference, costs are a big factor in the relationship between builder and user. Deviations from standard practice usually mean higher cost. But the user's main concern is for safety, good service life, and simple maintenance.

• **User approval**—The question of approval on the part of the user group came up several times. In many instances where strict adherence to the specifications would result in hardship to the builder, and where he could improve the design, the

ELECTRICAL STANDARDS

user should approve the change or omission.

The user problem was having complete information on the material, design, and application before the machine reached his plant.

In many cases *written* approval affects delivery as well as price, especially with custom-built machines where changes are required during the final stages of production or testing. Errors in the original design, unsatisfactory operation as an indirect result of mechanical or hydraulic changes, and component failure are among some of the factors.

• **Electrical drawings**—Much time was devoted to discussing the elementary diagrams, and the electrical layout and connection diagram. Using standard symbols in the elementary diagram and showing physical relationships of components and connections is important for simple, low-cost maintenance. But just *how* important the elementary diagram and connections diagram are in actual maintenance was debated. It's a matter of practice and employee training in each company. The revised Standards will include a sample diagram to aid the builder. Typical branch-circuit, protective arrangement diagrams will also be included.

Everyone agreed that the Standards should be as inclusive as possible. One of the greatest problems in the past has been the multiple references and cross references necessary to a complete understanding of any given requirement. The revised Standards will include several tables and diagrams to help this situation. For example, under the general subject of *Protection*, tables will show:

a. Maximum fuse and circuit breaker rating in percent of full load current for different types of motors.

b. Wire size for given motor starter sizes.

c. Maximum ampere rating of over-current devices for different wire sizes.

This parallels the same information given in the latest Machine Tool Standards.

• **Solenoids**—The statement that *Solenoids shall not be submerged in oil* was written to clarify the intent. The users do not want solenoids submerged in oil reservoirs or tanks containing the operating oil of the system. However they do not rule out solenoids enclosed in their own oil.

• **The Small User**—The problem of the small, or low production user picking up these Standards and not realizing all that is involved can be serious to the builder. This is not the responsibility of the high production user, and he should not be criticized for his efforts to write good standards for his own use. The small user usually does not need the Standards in their entirety, and is usually not in a position to pay for complying with them. Much education is needed in deciding whether or not to use the Standards. ▼▼▼

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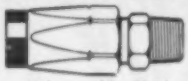

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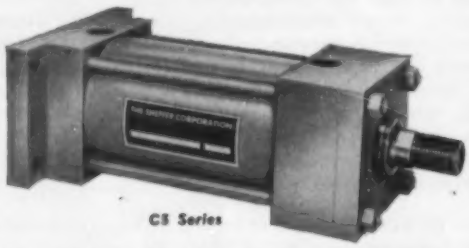

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Concluded from page 68

gether and there would presumably be no cylinder movement due to oil pressure. However, if the line to the tank is of sufficient length or small enough size to create high flow resistance, there will be pressure drop in that line. This pressure applied to both cylinder ports will cause cylinder drift in the same fashion as with the closed-center valve.

Actually, the single-rod cylinder used with an open-center valve behaves like a simple ram. The effective force is a function of the rod area. Shock waves transmitted to a common tank port may cause the piston to move just enough to clear limit switches or other interlock devices and upset the machine cycle.

In such applications there are three types of valve spools which may be used to minimize or prevent cylinder drift while connecting the pressure port to tank when the four-way valve is in the center or *off* position, Figure 6 b, c, d. In these valves, the pressure drop in the tank line does not produce creep because one or more cylinder ports are blocked to prevent movement and because the connection of the pressure line to tank effectively prevents any leakage to the blocked port or ports. Thus the condition existing with the closed-center valve cannot give trouble.

The spool configuration shown in Figure 6*d* is widely used where directional control valves are connected in series. Minimizing pressure in the cylinder lines during the idle portion of the machine cycle with this valve, removes the force which causes drift. When this spool design is used, the cylinder connected to it may drift if the valve is pressurized from a downstream valve in series. In such an instance, a modified parallel circuit incorporating other means for dropping pressure between cycles must be used. ▼▼▼

DECELERATING AN INDEX TABLE

Concluded from page 71

feeding cylinder solenoids of valves *A* and *B* are both actuated. This connects pump output through valve *A* to the head end of the cylinder. Exhaust from the rod end is connected through the counterbalance valve, valves *B* and *A*, and the check valve to tank. The check valve is required to maintain pilot pressure since the hydraulic valve operators are actuated from the main pressure line. When the machine is shut down, the counterbalance valve maintains fluid in the rod end of the cylinder and prevents lunging of the drills at the beginning of the first rapid advance stroke.

At the start of feed, the solenoid of valve *B* is deactuated, so that exhaust from the rod end of the cylinder is forced through the flow control valve which adjusts the rate of feed. For rapid return the solenoid of valve *A* is de-energized and the solenoid of valve *B* is energized. Flow is then connected to the rod end of the cylinder, bypassing the counterbalance valve through the check. ▼▼▼

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Electric resistance welded steel tubing gives you positive mechanical and fluid-flow advantages which are not available in tubing made by other processes . . . or, from other metals.

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MAXIMUM AVERAGE READINGS (Microinch)

Outside Diameter	Wall Thickness		
	0.065 and under	Over 0.065 to 0.150 incl.	Over 0.150 to 0.187 incl.
½ to 2½ in. inclusive	40	45	55
Over 2½ to 4½ in. inclusive	40	50	60

Suggested Procedure

for Making Microinch Readings on Interior Surfaces of Cold Worked Tubing (not Polished or Ground) ½-inch I.D. and Larger.

Section 1. Measurements on tubing with longitudinal or no predominate lay should be circumferential on the inside surface of the straight tube, prior to any fabrication in a plane approximately perpendicular to the tube axis. Measurements on tubing with circumferential lay should be longitudinal.

Section 1-A. Measurements should be made not less than 1 inch from the end.

Section 1-B. Measurements should be made at four positions approximately 90 degrees apart or over a complete circumference if the trace should otherwise overlap.

Section 1-C. The length of trace should be in accordance with Section 4.5 of ASA Standard B46., latest revision. (Not less than 0.600 inch long.)

Section 1-D. A minimum of three such measurements should be made spaced not less than ¼ inch apart along the longitudinal axis.

Section 1-E. The numerical rating shall be the arithmetical average microinch of all readings taken. Each reading to be averaged should be the mean position of the indicator during the trace; any momentary meter excursions occupying less than 10 percent of the total trace should be ignored.

Section 1-F. A deviation in numerical rating in various parts of a tube may be expected. Experience to date indicates that a variation of about plus or minus 35 percent is normal.

Section 2. Instruments should meet the specifications given in ASA Standard B46., latest revision.

Section 3. Mechanical tracing is preferred. If hand tracing is used, the speed of trace should not vary by more than ± 20 percent from that required to give the appropriate cutoff. The 0.030 inch roughness with cutoff should be used.

Section 4. Microinch determinations only refer to roughness of areas that do not contain a defect, injurious or otherwise. Such defects as seams, slivers, pits, laps, etc., are subject to ordinary visual inspection in accordance with applicable specifications or trade customs, and have no relationship to roughness.

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Permits easy cleaning!

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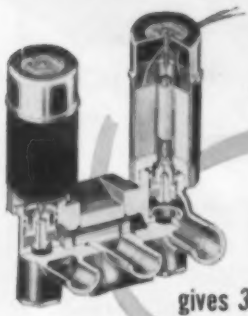

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ATKOMATIC VALVE CO., Inc.
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INDIANAPOLIS, INDIANA

ELECTRO-HYDRAULIC OSCILLATOR

Concluded from page 74

supply to peak flow in the load is 8.5:1. This demonstrates that use of the oscillator reduced pump capacity required by this amount.

• **Search Radar Modifications**—Application of the hydraulic oscillator to radar scanning requires that linear motion of the piston be converted to rotary motion. This is accomplished by linkages or rack and pinion gearing. As an alternative, a rotary actuator might be substituted for the piston and coupled directly to the antenna mount.

Since a search radar system must not only scan but track the target when located, an additional modification of the circuit is necessary. Oscillation is stopped and the system converted into a position servo by inserting two normally-open, solenoid-operated valves in the lines to the accumulators at the points labelled *a* in Figure 3. When a target is found, these valves are closed to take the accumulators out of the circuit and stop oscillation. A tracking signal may then be fed into the amplifier to control position. ▼▼▼

HOW TO DESIGN O-RING SEALS

Concluded from page 87

machining on a production basis. The D and R dimensions are not critical as indicated by fractional and two-place decimal notation, but it is important that the corners be broken smoothly with no burrs.

Figure 3 shows the same type of reciprocating land dimensioned for anti-extrusion rings. In this case, the D dimension is more critical, +.000/—.005, as the groove length should be equal to the installed cross-sectional length of the O-ring plus the thickness of the anti-extrusion ring or rings.

An undercut groove will reduce the running friction of O-ring seals, but this gland design is rarely used due to higher manufacturing costs and a greater tendency for the O-ring to extrude. However, in the pressure range of 200 to 1000 psi, and where running friction is highly critical, this is a worthwhile gland design to investigate. Figure 4 shows the design. The R dimension is more critical than in normal rectangular designs, and it is advisable to have downstream drain ports as shown, to avoid trapping the fluid.

• **Rotating Applications**—A different problem, is presented by rotary O-ring seals, Figure 5. Because rubbing contact is limited to a relatively small area, heat dissipation is much slower than with reciprocating seals and surface finish of the shaft in the rubbing contact area is highly critical. With a very refined surface contact area, it is often possible to reduce cross-sectional squeeze consid-

erably, thus further helping the frictional and heat dissipation situation. Groove length for a rotary O-ring seal is also critical, as the ring is apt to "snake" in the groove if this dimension is excessive. If the fluid-rubber combination is known to produce no swelling of the O-ring, this dimension should be equal to the installed cross-sectional length of the ring, and may be up to 10 per cent greater than this length if swelling is anticipated.

Due to the "Joule effect", the diameter of a stretched O-ring shrinks somewhat when heated. This makes O-ring diameter selection probably the most important single factor in a rotary application. To counteract this effect, the actual O-ring inside diameter should be larger by .010 to .020 per inch than the shaft on which it is installed. This means either non-standard shaft dimensioning, or special size O-rings for standard fractional diameter shafts. Otherwise, the O-ring is apt to rotate with the shaft and fail rapidly from abrasion at the bottom and walls of the groove.

• **Static groove shape**—Figure 6 illustrates the so-called standard static gland design. Under steady pressure conditions the D dimension is not critical. Where pulsation is present, it is desirable to make D equal to the installed cross-section length of the O-ring to minimize motion in the groove. If the magnitude and/or frequency of the pulsations is high, it is sometimes advisable to use anti-extrusion rings, as shown in Figure 7, which is the usual gland design where the clearance gap exceeds the values of Figure 1. For low or non-pulsating pressure face type grooves it is best to make the inside groove diameter equal to the low tolerance ID of the O-ring used, and the OD equal to the high tolerance of the O-ring OD. In this way any tolerance O-ring will lay in the groove for easy assembly.

When a face type static O-ring is used and cannot be installed in a horizontal position, it is sometimes difficult to hold the ring in place during assembly. The gland in Figure 8 overcomes this by making the O-ring a slight stretch fit over an undercut side wall. Particularly in the case of large installations, this greatly simplifies assembly.

When an O-ring must be positively retained in its groove, as on items such as hatch covers, a groove with both side walls undercut, as shown in Figure 9, gives good positive retention. In this design the R dimension must be kept small to provide sufficient gland volume for the installed and squeezed O-ring.

The Vee-gland in Figure 10 will allow a higher pressure-clearance gap combination for non-pulsating static seals, than those listed in Figure 1. Extrusion of an O-ring into a given clearance gap is proportional to the amount of stress necessary to move the rubber to the gap. With the Vee-groove, the total stress of assembly and applied pressure required to move the O-ring is much higher than in a conventional groove, and the extrusion tendency is lowered. However, wear is also proportional to stress, and this design should not be considered for dynamic or pulsating pressure static seals. ▼▼▼

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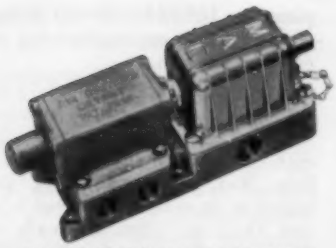

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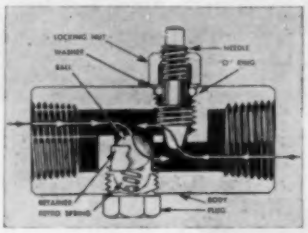
Features: Valve combines two types in one compact body design. Floating retroball check provides full flow in one direction; tapered, fine thread needle gives wide range of adjustment of flow in opposite or controlled direction. Sensitivity of



the ball and fine adjustment of the needle controls applications considered impracticable by other means. Applications include inlet and exhaust speed control for double acting cylinders, speed control of cylinders in parallel, and two-way speed control of a hydraulic pumping system.

Specifications: Valve bodies are machined from hex-bar brass and aluminum for 2000 psi and stainless steel for 5000 psi. Other parts are stainless steel.

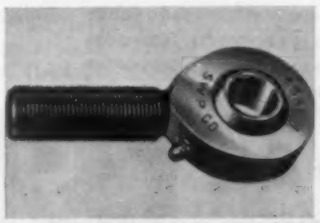
Modrich Fluid Controls, Inc.
Crystal Lake, Ill.

Circle 155 on Reader Service Card

ROD END BEARINGS
. . . are self-aligning

Designation: BREM & BREF

Features: Bearings are two-piece, self-aligning, plain, spherical, rod end type, designed for aircraft, mis-



sile and related industries. Units reduce lost motion in linkages and withstand excessive vibration. They carry heavier loads than anti-friction types as they have a greater surface supporting area.

Specifications: Bearings are made integrally of one-piece ball and one-piece body, take radial and axial thrust load and offer longer bearing cycling life. Available in sizes for ¼ to ¾-in. bore and larger, with capacities of radial ultimate loads from 7,000 to 33,300 lbs and higher. Same bore sizes available for high-temperature operations to 1000 F.

Southwest Products Co.
Monrovia, Calif.

Circle 156 on Reader Service Card

PRESSURE RATE INDICATOR
. . . features fast response

Designation: PI-114

Features: Unit permits precision rate or dynamic pressure measurements under severe conditions. Using an adapter and resistor element, current generated in the quartz-

crystal transducer is measured by an electrostatic-type amplifier and displayed on a standard oscilloscope or recorder. Indicator features fast response—15 microsecond rise time—and high sensitivity, and should be useful in evaluation of hydraulic or pneumatic systems.

Specifications: Precision stainless-steel pickup withstands temperatures up to 600 F without special air or water cooling. Amplifier-calibrator unit contains circuitry for calibration of the pickup, adjustment of the oscilloscope and for signal evaluation. Constant calibration, independent of temperature is achieved by static means.

Kistler Instrument Corp.
North Tonawanda, N. Y.

Circle 157 on Reader Service Card

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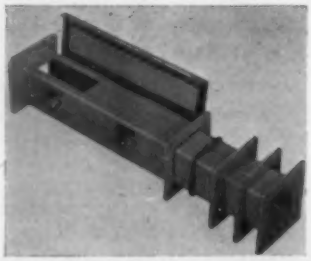
New Products continued

TELESCOPING FITTINGS
. . . are oil-tight



Features: Fittings are designed for use on wireways on machinery or in buildings where oil and dust are problems. Telescoping section permits adjustment to any desired length. After adjusting the unit to the proper length, the O-ring gasket and the two sliding retainer plates are bolted to the end flange of the straight section, forming an oil-tight junction.

Specifications: For use on 2-½ by 2-½, 4 by 4, and 6 x 6 in. gasketed wireways. Telescoping section for each of the three sizes is 15-½ in. long, and permits adjusting the length of an assembly between 1-½ and 13-½ in. Units are made of 14-gage steel except for the welded end flange and the two sliding sleeves, which are 11-gage steel. Finish is baked enamel over a phosphatized surface.

Hoffman Engineering Corp.
Anoka, Minn.

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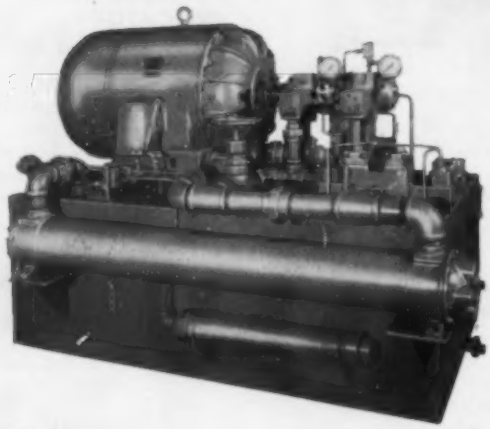

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. . . effective at 2000 psi

Designation: Model HP31

Features: This high-pressure lubricator introduces a controlled oil fog into an air stream at normal working pressures up to 2000 psi,

and has been tested successfully at pressures up to 3000 psi. Unit is small, compact, has conveniently located mounting brackets, and is designed to tee into any high-pressure air line. Reservoir capacity of one quart eliminates the necessity of continuous filling.

Design: Line pressure is introduced through a valve into the oil reservoir, pressurizing the oil. At this point, the air line and reservoir pressures are equal. When the operators start the air tools, or any air-actuated mechanism, the air line pressure momentarily drops. At this moment the back pressure in the reservoir forces a fog of oil into the air line. This fog of oil is suspended in the air and provides perfect lubrication.

The Rucker Co.
Oakland, Calif.

Circle 159 on Reader Service Card

SOLENOID VALVES
. . . offer choice of power

Features: Developed to improve valve adaptability by allowing an option on choice of power, this new electrical configuration involves only a slight weight and dimensional increase over the 24-v dc valves. Design permits conversion of most existing equipment. Wide frequency range of the 115-v, 400-cycle ac configuration allows

operation of units at full performance from conventional 60-cycle ac domestic power supplies.

Specifications: For example, balanced-poppet MV74 model, which is supplied for 400-cycle ac service as Model MV74B, is a 3-way, 2-position unit for 3000 psi service, can be used either normally open or normally closed, and weighs less than one pound.

Marotta Valve Corp.
Boonton, N. J.

Circle 160 on Reader Service Card

ELECTRONIC TIMER
. . . features accuracy without resetting

Designation: Model 1310

Features: Unit gives accurate timing of sequences from one second to 60 seconds, and will perform

many technical and industrial applications requiring accurate repeat timing. A separate switch permits checking or inspection by allowing a constant current to pass to any device in use. After this is per-

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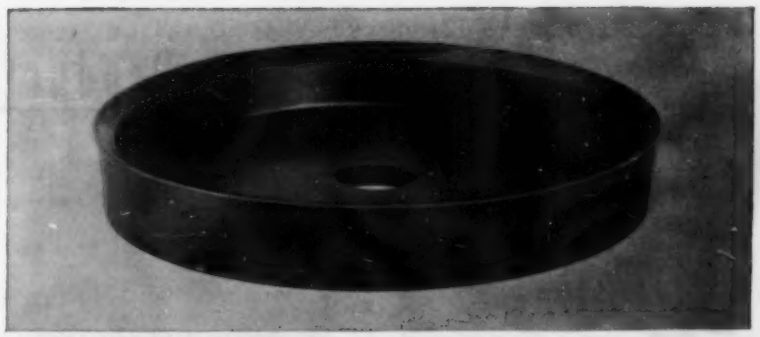

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formed the switch is placed in the "time" position. Timer has an outlet for the supply cord from any device.

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Photo Materials Co.
Chicago, Ill.

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SOLENOID PILOT VALVES . . . feature quick response

Designation: Types HPV7/11, LPV7/11, ELPV7/11

Features: High pressure valve, Type HPV7/11, extends the maximum working pressure to 250 psi in hydraulic systems. LPV7/11 has a large bore for rapid signal response in pneumatic applications at 60 to 80 psi. ELPV7/11 is designed for reliable operation at air pressures of 15 psi or less.

Specifications: Units feature glandless poppet-type construction and are suitable for use with air or oil. Solenoids are dc, resulting in quiet operation without chattering or

over-heating. Speed of response is high. Units can operate at frequencies in excess of 600 cycles per minute for any desired period. Model HPV7/11 has a $\frac{1}{16}$ in. bore, LPV7/11 has ⅛ in. and ELPV7/11, $\frac{3}{16}$ in.

Pneumatics Div.
Baldwin Instrument Co. Ltd.
Dartford, England

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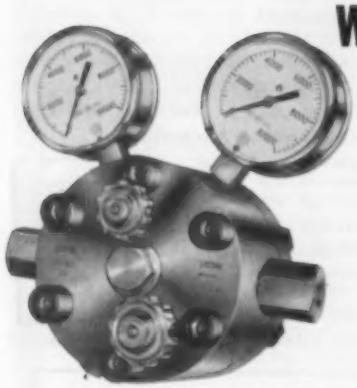
Control Gases to 10,000 P.S.I.

WITH VICTOR GAS-O-DOME REGULATORS



Gas pressure, not springs, control diaphragm motion to give you precise regulation of high-pressure gases at high or low flow rates. Can be remotely controlled if desired. Safety valve furnished on request. More than 55 stock models in the following series:

GAS-O-DOME SERIES	DELIVERY RANGE (p.s.i.)	SPECIAL FEATURES	GASES HANDLED
GD 30	0-2500	High Delivery Flow Rates. Accurate Valve Control.	Air, Argon, Helium, Hydrogen, Nitrogen, Oxygen —and others non-corrosive to bronze and stainless steel.
GD 31	0-3600		
GD 61B	0-2500	Excellent Capacity. Compact— 7 lb.— 4" x 6" x 6". —67° to +160° F. Range.	
GD 62B	0-3600		
GD 80	0-5000	Accurate Valve Control. —67° to +160° F. Range.	
GD 81	0-10000		
GD 10	0-500	Self-Relieving Pilot Regulator Control. High Flow Rates.	
SR 10	0-1000	High Pressure, Low Flow. Compact—4 lb. —2" x 6" x 6".	
SR 100	0-30 & 0-40	Corrosion Resistant.	Ammonia (wet or dry) Boron Trifluoride Chlorine (wet or dry) Hydrogen Sulfide, Hydrogen Chloride, Sulfur Dioxide—and other corrosive gases.

VICTOR'S LONG EXPERIENCE IN PIONEERING HIGH PRESSURE GAS REGULATION *is yours for the asking. For details, and complete data on Gas-O-Dome Regulators, see your VICTOR dealer or write us for catalog 341. Dealer inquiries invited.*

VICTOR EQUIPMENT COMPANY
Mfrs. of welding & cutting equipment, hardfacing rods, blasting nozzles; cobalt & tungsten castings.
844 FOLSOM ST. • SAN FRANCISCO 7 21

Circle 136 on Reader Service Card

PLUG-IN PRESSURE GAGE
. . . gives quick readings

Designation: Hydra-Chek

Features: Pressure checks may be quickly and easily taken with a plug-in-jack type gage installation. Suitable for locations where permanent gage installations are omitted due to hydraulic shock, mechanical vibrations, and possible damage due to external causes.

Application: Method requires two parts: Gage pressure tap, ¼-in. MPT, installed in fluid line eliminates pipe plug connections, shut-off valve, or shutting down the system; and gage adapter, ¼-in. FPT, fastened permanently to the pressure gage. To check a pressure, the cap is removed from the valve-sealed tap and adapter is inserted. Tightening down the union nut opens the valve and the gage registers the system pressure.

Specifications: Maximum working pressure is 3000 psi. Unit is made of steel, cadmium plated.

Republic Mfg. Co.
Cleveland, Ohio

Circle 163 on Reader Service Card

HYDRAULIC CONTROL VALVE
. . . has built-in pressure relief

Designation: SU-1200F

Features: Unit offers positive, flexible control in all hydraulic operations, and is available as a complete control unit, including tank, valve, piping and controls for simple, compact installation.

Specifications: Valve has a capacity of 40 gpm in four operating positions: raise, hold, lower and float. Extra features include: built-in pressure relief, spring tension controlled, spring return to neutral from non-float positions, positive manually operated float position with "threshold feel".

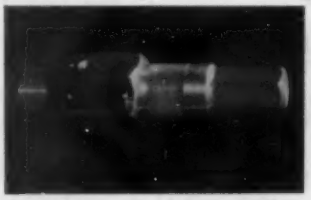
Be-Ge Mfg. Co.
Gilroy, Calif.

Circle 164 on Reader Service Card

RELIEF VALVE
. . . offers quiet operation

Designation: Series 44

Features: Designed for full capacity at 25% over-pressure, with long,



soft spring, 45-degree seat and top and bottom disc guides for noise-free operation. Interchangeable inner valve assembly can be replaced in the field without special tools and without removing the valve from the line or changing the original set pressure more than 5%. Valve is very compact and suitable for use in aircraft, machine tools and similar applications.

Specifications: Available in aluminum up to 3500 psi and carbon steel and stainless steel up to 10,000 psi. Other alloys and chrome plating available. Sizes ¼, ⅜, and ½-in. inlets and outlets.

Fluid Mechanics Co.
Bellaire, Texas

Circle 165 on Reader Service Card

Continued on next page

Make Good Design Even Better . . .

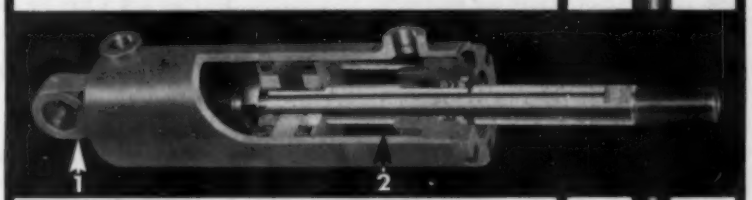
BHEW Made-to-Order HYDRAULIC CYLINDERS

Whatever your cylinder requirements, you're sure of dependable operational performance with efficient, close-tolerance BHEW cylinders that require minimum mounting space. Built to meet your specifications, their cost is reasonable; there is no charge for tooling; they are delivered on schedule.

BHEW CYLINDER FEATURES: • Standard and special designs available. • Double or single acting and telescopic. • 1½" to 8" bore. • Strokes up to 156". • Smallest possible O. D. and retracted O. A. length. • Oil cylinders with 1,500 psi or 3,000 psi working pressure, pneumatic up to 150 psi. • Cup-type, ring-type or O-ring construction. • Choice of mounting.

For full information, send us specifications of your requirements.

Double-Acting 2-piece Piston Rod Cylinder. It is excellent for extending and retracting boom arm. Both hoses are connected on rod end. →



1. Hinged mount for alignment.
2. Honed steel cylinder.

Do you have cylinder problems? Our engineers will be happy to work with you without charge.

BHEW BENTON HARBOR ENGINEERING WORKS, Inc.

622 LANGLEY AVENUE, ST. JOSEPH, MICHIGAN

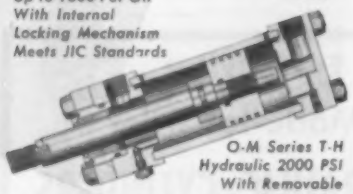
Circle 19 on Reader Service Card

O-M CYLINDERS

(AIR AND HYDRAULIC)

have everything

O-M Tie-Rodless
150 PSI Air
Up to 1500 PSI Oil
With Internal
Locking Mechanism
Meets JIC Standards



O-M Series T-H
Hydraulic 2000 PSI
With Removable
Gland Cartridge
Meets JIC Standards

Construction and performance features that keep O-M cylinders right in the middle of...

AUTO-MATION

- Smooth, dependable operation at all practical speeds.
- Precision-honed, seamless steel body.
- Shock and vibration resistant.
- High-tensile alloy steel piston rod—ground, polished and hard-chrome plated.
- Multiple lip, self-compensating rod gland packing on all hydraulic cylinders.
- Self-compensating piston and rod packing on all cylinders, with packings available for fire-resistant fluids, also wide temperature ranges.
- Machined bearing bronze bushings for maximum service with minimum friction.
- O-ring static seals throughout with no flat gaskets to leak.
- Efficient wipers or scrapers on piston rods.
- Rolled steel precision machined end caps with ample sized ports.
- Adjusting needle for cushion control with ball checks for rapid full power starts.
- Versatile port orientation.
- Wide range of mounts and mounting accessories available.
- Easily maintained—parts subject to wear can be repaired with minimum downtime.
- Plus many other features.

O-M Air and Hydraulic Cylinders are available in 1½" to 8" bores with standard and heavy-duty piston rods.

Mail coupon today for Bulletins 101A (O-M Tie-Rodless Cylinders) and 105 (O-M Series T-H Hydraulic Cylinders).

ORTMAN-MILLER MACHINE CO.
1 143rd Street, Hammond, Indiana

☐ Have representative call
☐ Send Bulletins 101A and 105

Name _____ Position _____
Company _____
Address _____
City _____ Zone _____ State _____

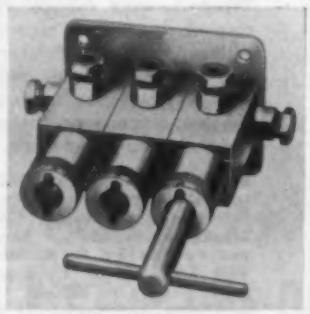
New Products continued

PNEUMATIC MANIFOLD VALVES
. . . offer fool-proof operation

Designation: Models 1583 and 1563

Features: Both models feature fool-proof, manifold operation and quick, air-tight action, without the necessity for turning and tightening handwheels. These valves should be ideal for pneumatic instrument and control installations and other pneumatic systems.

Design: Model 1583 consists of a 2-position piston sliding in a 2-port cylinder, and is normally closed. Valve is moved to open position by inserting and turning a key one-quarter turn. When the key is withdrawn, the valve closes automatically under spring tension. Key is



attached to the valve by a ball chain. Model 1563 is the duplex unit and consists of two, mechanically-linked, 2-port, 2-position, piston-type valves, normally held closed by spring tension. With one-quarter turn of the key, both valves are simultaneously moved to the open position. Valves close automatically upon withdrawal of the key.

Petrometer Corp.
Long Island City, N. Y.

Circle 166 on Reader Service Card

HYDRAULIC SUMP FILTER
. . . gives depth filtration

Features: Filter is one-piece, made of sintered powdered metal, giving controlled depth of filtration, and providing large filtering area and high flow capacity with negligible pressure drop. Design simplicity permits reduced manufacturing costs, resulting in filters for replacement with minimum down time, rather than loss of time, expense and mess of cleaning a used filter.

Available in six ranges of flow capacity from ¾ through 1-½-in. pipe size.

Arrow Tools, Inc.
Chicago, Ill.

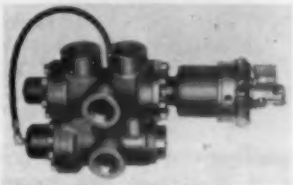
Circle 167 on Reader Service Card

FOUR-WAY HYDRAULIC VALVE
. . . is semi-automatic

Designation: E-400-X Series

Features: Valve provides leak-free operation with water, glycol or oil-base hydraulic fluids. Activated by an integral double-acting cylinder, controlled by a single or double-solenoid, pilot-operated valve, the unit offers maximum operating safety since it will not reverse itself in case of air or electrical supply failure.

Specifications: Corrosion-resistant materials are used throughout. Cast Navy "M" bronze bodies, hardened stainless-steel valve stems and re-



placeable seat sleeves, plus Stellite seats, assure long life with minimum wear. Valves are available in 1, 1-½ and 2in. NPT sizes, for line pressures up to 3000 psi. 60 to 125-psi air is used for actuation.

Sinclair-Collins Valve Co.
Akron, Ohio

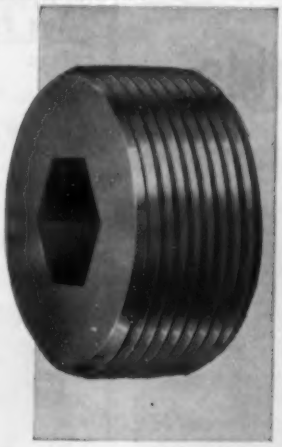
Circle 168 on Reader Service Card

Continued on page 144

Circle 119 on Reader Service Card

specify standard UNBRAKO

Dryseal-thread Pressure Plugs for hydraulic or fuel systems



Use them wherever liquids or gases must be contained under pressure—or in place of ordinary pipe plugs. UNBRAKOS seal without compound. They are made of the same high-strength alloy steel, have the same internal wrenching feature as UNBRAKO socket screws. Fully formed threads exceed NPTF specifications. Standard sizes—⅛ to 1¼ in.—are stocked by your authorized industrial distributor. See him for details. Or write Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 2, Pa.

UNBRAKO SOCKET SCREW DIVISION — STANDARD PRESSED STEEL CO. SPS JENKINTOWN PENNSYLVANIA

"Wipe out" PACKING FAILURES WITH Seal-Guard METALLIC ROD WIPERS

Self-adjusting, easy to install, Seal-Guard's knife-like bronze rings "wipe off" all dirt and grime, will not mar the rod, are oil and heat resistant and friction-free.

HOW SEAL-GUARD WORKS

1. **Twin wiper rings are mounted on rod with notches staggered.**
2. **Cushion ring is compressed on assembly exerting constant inward pressure keeping ring in constant contact with rod.**
3. **Harmful substances are completely cleared by scraper action.**

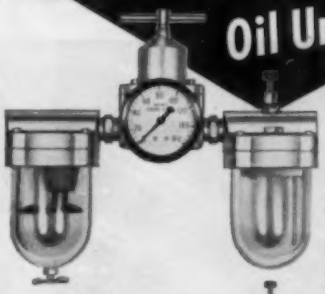
Seal-Guards are available to fit rod diameters from ¼ to 24 inches. Other sizes by special order.

WRITE FOR DESCRIPTIVE LITERATURE.

HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

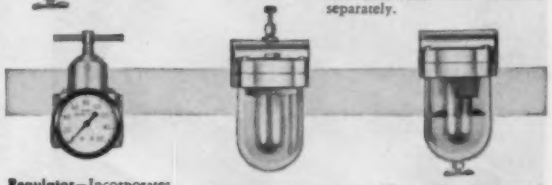
Circle 4 on Reader Service Card

AIR-MITE FILTER—REGULATOR Oil Unit



- **Instantaneous response to demand**
- **Special Filter for cleaner air**
- **Accurate injection of pre-atomized oil**

The new AIR-MITE unit is designed and built for maximum operating efficiency, easy maintenance and long life. Operates at pressures to 160 psi. Available in ¼", ⅜" and ½" T.P. sizes. Individual units available separately.



Regulator—Incorporates piston cup instead of diaphragm. Provides more accurate, stable regulation, lasts longer. Direct reading gauge for close regulation of outlet pressure.

Lubricator — Automatically pre-atomizes and feeds oil mist into air stream. Simple micro adjustment permits accurate balance of oil-to-air supply.

Filter — Porous sintered bronze element filters better . . . won't collapse . . . is easy to clean. Built in air baffle. Brass drain cock.

Write for catalog sheets and prices.

AIR-MITE Devices, Inc.
4401 W. KINZIE STREET • CHICAGO 24, ILLINOIS

THERE IS NO SUBSTITUTE FOR THE MORE ECONOMICAL, MORE DEPENDABLE, LONGER SERVICE LIFE OF

Engineering and design service available.
Write for price information and catalog data.

grover
PISTON RING CO.
120 N. BROADWAY • MILWAUKEE 2, WIS.

MANUFACTURERS OF
INDUSTRIAL PISTON RINGS FOR HIGH COMPRESSION SERVICE

Circle 142 on Reader Service Card

WesCo miniature solenoids...

do big jobs in small space

- Completely tested
- Proven reliable
- Mounting furnished to meet your requirements.
- Hundreds of other designs for both AC and DC application.
- Push or pull units to 200 lbs. force.
- Send your specifications today.

WesCo *The trademark on millions of solenoids since 1927*

WEST COAST ELECTRICAL MFG. CORP.

233 W. 116TH PLACE • DIVISION 119 • LOS ANGELES 61, CALIFORNIA • PLymouth 5-1138

Hydraulic CYLINDERS to specification

AT your service — since 1918 — the most modern machine tools to handle up to 15" I. D., including the last word in honing equipment and the most accurate of precision gauging equipment. Everything we do is to specification. Expanded facilities permit prompt delivery of 1 or 1000 pieces in any material desired.

Call Erie 2-3664 - Send specifications to

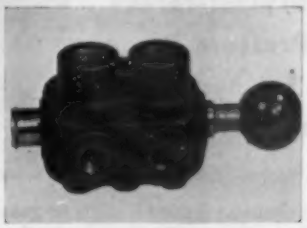
AMERICAN HOLLOW BORING COMPANY

1954 Raspberry St., Erie, Pa.

New Products / continued

TWO-WAY SELECTOR VALVE
. . . saves extra pump

Features: Unit will operate two banks of valves or two, 2-way cylinders from one source of oil. An



extra pump, valve bank, or oil reservoir may be eliminated where more than one of them is used on a piece of equipment.

Specifications: Designed for service at 2000 psi, with casting of semi-steel alloy and spool valve steel hardened and ground. Available with 15 or 20 gpm flow rate, in ½ or ¾-in. pipe size.

Williams Machine & Tool Co.
Omaha, Neb.

Circle 169 on Reader Service Card

AIR COMPRESSOR
. . . for low pressure

Designation: MC 970-10

Specifications: Designed to furnish low pressure air for equipment pressurization and low pressure

pneumatic accessories. Unit consists of a three cylinder, single stage compressor, combined with an integral ac, 3-phase, 200 volt, 400 cycle electric motor. Rated capacity at sea level is 6 SCFM at 30 psi outlet pressure. Suitable for operation from —65 to 165 F, and from sea level to 50,000 feet. Bearings are friction-less type and oil capacity is sufficient for 100 hours. Complete unit weighs only 19.7 lbs.

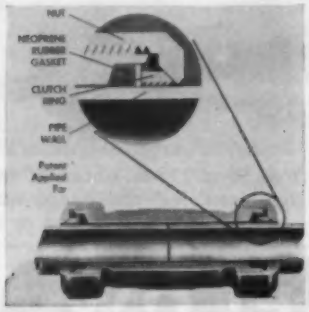
M. C. Mfg. Co.
Lake Orion, Mich.

Circle 170 on Reader Service Card

THREADLESS PIPE FITTINGS

. . . have strong gripping action

Features: Fittings are factory assembled, ready for use in joining steel, wrought iron or plastic pipe. No threading, grooving, flaring or welding is necessary. Strong gripping action is achieved through a brass clutch ring with internal serrations which grip the pipe wall as the fitting nut is tightened. At the same time, a neoprene gasket is compressed against the pipe wall. **Specifications:** Available in couplings, adapters, 90-degree elbows and tees. Fittings withstand traction forces up to 3600 lbs, and pressures from 450 psi on 2-in. pipe to 500 psi on ½-in. Units are made from high-tensile, corrosion-resistant malleable iron to ASTM specifications. Available in galvanized



or Parkerized rust-proof finish. Machined brass stifferners are available for joining plastic pipe and tube, preventing cold flow.

Telsco Fittings Div.
Dallas, Texas

Circle 171 on Reader Service Card

SYNTHETIC RUBBER ENAMEL

. . . protects hydraulic equipment

Designation: Pliogard

Features: Material protects finish on hydraulically operated equipment against corrosive effects of hydraulic fluids. **Specifications:** Material is a high-solids, chemical-resistant, synthetic-rubber coating made from styrene butadiene resins. It air-dries, dust-free in 30 minutes to a tough, adherent, chemical-resistant film on metal, wood, concrete, etc. No primer is necessary, and application can be made by spray, brush, dip or roller. Coverage is 500 sq. ft. per gallon to a dry film thickness of

Continued on next page

eats HEAT

BELMONT "Compressor"

Looking for an air compressor rod packing that stays flexible under intense dry heat?

Belmont "Compressor" No. 760 withstands such gruelling service—and protects compressor rods from premature wear.

This asbestos packing is lubricated strand by strand, braid by braid, layer by layer—to retain its flexibility and good sealing qualities.

Use it for longer life, less maintenance. Write for Catalog 56.

The Belmont Packing & Rubber Co.
Butler & Sepviva Sts., Phila. 37, Pa.

ask your BELMONT Distributor

such leading Packing Distributors as:

Indianapolis Belting & Supply Co. in Indianapolis
and
Walter B. Gallagher Co. in Philadelphia

are ready to serve you promptly and helpfully, wherever you are.

BELMONT

Circle 132 on Reader Service Card

One leak or a thousand . . . if you have a similar frustrating experience in a metal-to-metal static sealing problem, United's Metallic O-Rings are the answer!

They fit any application calling for a positive, permanent seal against internal or vacuum pressures up to 10,000 p.s.i., in a temperature range from –70 to 1800° F. They are especially adaptable for sealing cylinder heads, air and hydraulic pressures, high octane fuels, vapors, gases, oils, solvents, chemicals, acids, vacuum and steam connections. Available in various metals and finishes, ⅜" to any size or configuration.

For free 22 page booklet describing United Metallic O-Rings, write (on your letterhead please) to Department **6-2.**

UNITED METALLIC "O" RING CORP.
Dayton, Ohio • Box 1038
Division of United Aircraft Products, Inc.

New Products continued

colors, or to specifications. Material withstands temperatures to 250 F continuously, higher for intermittent service.

Saran Protective Coatings Co.
Ferndale, Mich.

Circle 172 on Reader Service Card

FLUID POWER CYLINDERS . . . withstand severe service

Specifications: Units are heavy-duty, 3500 psi, double-acting type, available in eight basic sizes: 2, 2-½, 3-¼, 4, 5, 6, 7 and 8-in., with either standard or large diameter rams. Length of stroke varies

from 36 to 158-in. Choice of foot lug, center lug, and flange head mountings can be combined or in-

TRU-O-SEAL
TEFLON SEAL
STOPS PIPE THREAD LEAKS
PAT. PENDING
Satisfaction Guaranteed Or Money Back TRIAL OFFER
TRU-O-SEAL Fittings are guaranteed to seal pipe thread connections permanently against all oils, practically all known chemicals and gases; to seal under high pressures or vacuum; to withstand —280° to plus 500° F.; to eliminate "overtightening" damage and pipe dope. Available in ⅛" to 2½" pipe thread sizes.
$10.00 Trial Offer No. 1: eight ⅛", ten ¼", eight ¾", ten ½" pipe thread TRU-O-SEAL Fittings.
$10.00 Trial Offer No. 2: eight ½", ten ¾", four 1" pipe thread TRU-O-SEAL Fittings.
Send order to
TRU-O-SEAL DIVISION
Flick-Reedy Corporation
2008 N. Hawthorne • Melrose Park, Ill.
"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.
Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed).
SEAL SIDE
Thread pipe or fitting 4 threads into port. Point in desired direction.
Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).

HI-FLOW
SUCTION STRAINER
with Replaceable Screen
FEATURES:
• Easily replaceable screen
• Low pressure drop
• Any mesh screen to 30 micron
• All GPM Sizes
• Quality Construction at Low Cost
No synthetics—no plating—only steel and monel screen used.
Write today for catalog and prices.
HI-FLOW FILTER CO.
515 University • Detroit 30, Michigan
Distributor inquiries invited

Circle 128 on Reader Service Card

Circle 55 on Reader Service Card

terchanged, front or rear. Also available with adjustable hydraulic cushions in either head, or both; air vent plugs; double ram ends; and special packings for fire resistant fluids.

The Oilgear Co.
Milwaukee, Wis.
Circle 173 on Reader Service Card

TIME DELAY AIR VALVE . . . is solenoid operated

Designation: BVP-ATD

Features: Valve is suitable for any application requiring a time delay between release of the electrical impulse on the solenoid of the air valve and the return of the cylinder to original position. Delay time is adjustable between zero and 30 seconds, with repetition accuracy of ± 10%. Time delay is built into the valve so no special switching is required to accomplish the time lag. Unit is available in ¼ through 1-in. port sizes.

Beckett-Harcum Co.
Wilmington, Ohio
Circle 174 on Reader Service Card

MOLDED RUBBER PARTS . . . feature accurate dimensions

Features: Parts are small, custom molded for aircraft and missiles,

for pneumatic or hydraulic service. Using synthetic rubber compounds, precision parts are produced with unusual configurations, to extremely close tolerances, including very small shapes where accurate dimensions and smooth surfaces are essential. Parts have excellent heat-aging properties, low temperature flexibility and withstand temperature extremes as low as —100 and as high as 500 F. Special compounds are resistant to hydraulic fluids, oils, solvents and dilute acids.

Stillman Rubber Co.
Culver City, Calif.
Circle 175 on Reader Service Card

positive, automatic PRESSURE CONTROL
you can depend on

FULFLO piston type, oil-relief hydraulic by-pass valves are designed and built so you can install 'em, then forget 'em! They are quiet, non-chattering because of shear-closing action. Low price and high quality, make Fulflo Valves a wise choice for O.E.M. use . . . replacement too! Available with "O" Ring or Gasket Seal.

- **Standard and Flanged models**
- **Just 6 springs for pressures to 500#**
- **Cast iron or brass bodies**
- **Brass, steel or stainless pistons**
- **Pipe sizes to 2½"**
- **SPECIALS to your requirements**

FULFLO

WRITE FOR "Fulflo Valves Mechanical Data Book", free helpful reference.

THE FULFLO SPECIALTIES CO., INC.
415 Fancy Ave., Blanchester, Ohio

Circle 43 on Reader Service Card

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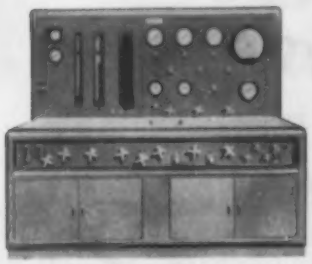

HIGH FLOW PRECISION HYDRAULIC COMPONENT TEST BENCH WITH REMOTELY CONTROLLED VARIABLE VOLUME POWER UNIT.

HASKEL

ENVIRONMENTAL
HYDRAULIC
PNEUMATIC
TEST EQUIPMENT

TEST STAND USED FOR PROOF TESTING PNEUMATIC MISSILE COMPONENTS PROVIDES AN AIR DRIVEN WATER CIRCUIT FOR 12,000 PSI HYDROSTATIC PROOF TESTING AND AN AIR DRIVEN GAS BOOSTER CIRCUIT FOR 6000 PSI GAS PROOF TESTING.

For precise testing of airborne components and ground checkout of missile and aircraft systems.

Custom designed test equipment built to your specifications, including complete environmental test facilities.
Brochure describing standard units available upon request.

HASKEL ENGINEERING & SUPPLY CO.
1236 South Central Avenue
Glendale 4, California

SOME TERRITORIES OPEN FOR REPRESENTATIVES

Useful Literature / continued

ENGINEERING HANDBOOK . . . on Teflon covers advanced useage in practical applications as a cushioning and insulating material for supporting clamps. Issued by TA Mfg. Corp., this 20 page handbook contains chemical, thermal, electrical and ageing properties as well as modern handling methods. Included is a tabulated chart covering 28 tests of the various physical properties of Teflon.

Circle 219 on Reader Service Card

COUPLING . . . for hydraulic or pneumatic service, features a design eliminating metal-to-metal contact between tube and fitting. Shocks and vibration are absorbed and fitting remains tight. Twelve-page catalog, released by Chicago Forging & Mfg. Co., gives details on the operation and features of the coupling, along with illustrations, cutaways, methods of installation and applications.

Circle 220 on Reader Service Card

PUMPING PROBLEMS HANDBOOK . . . published by Geo. D. Roper Corp., Rockford, Ill., provides valuable information for hydraulic engineers on the use of rotary pumps. Entitled "How to Solve Pumping Problems", the booklet gives general explanation of rotary gear pumps, pumping problems, sample problems and technical data. Data includes friction loss in hose, pipe and fittings; cylinder displacements; viscosities of fluids and vicosity conversion chart; specific gravities and converson tables; temperature converson table; electrical data; materials of pump construction; and conversion tables head to pressure.

Circle 221 on Reader Service Card

HOSE & FITTINGS . . . available from Hydralink Corp., Hazel Park, Mich., are covered in 8-page booklet. Line covers hose for medium and high pressure, reusable couplings, adapter unions and permanent couplings. Given in this catalog is a page of hose installation tips, showing the right and wrong ways to make asesmblies.

Circle 222 on Reader Service Card

FORGED STEEL FITTINGS . . . for high-pressure, high-temperature, or other severe fluid power applications, are produced by W-S Fitings Div., H. K. Porter Co., Inc., Roselle, N. J. Bulletin A-3-56 gives complete information with illustrations of items available. Line includes fittings of screw-end type; flange, O-ring flange and clamp-ring unions; socket-welding type fittings and welding bosses. Also included are 8 pages of engineering specifications and data useful to hydraulic and pneumatic engineers.

Circle 223 on Reader Service Card

CONTROL VALVES . . . for pneumatic and hydraulic service are illustrated and described in catalog published by General Controls Co. Items covered include valves of these types: Magnetic, on-off, proportioning control, electro-magnetic manual reset, magnetic-lever, bypass, magnetic piloted piston, magnetic 3-way and magnetic 4-way. Other items included are: Pneumatic pressure regulators, strainers and hydramotors.

Circle 224 on Reader Service Card

AIR HOSE . . . for all types of pneumatic service, is described in brochure issued by Boston Woven Hose & Rubber Co., Boston, Mass. Hose types range from those designed for the severest air hose duty to those made for light-duty air service. Brochure gives illustrations showing hose construction, along with complete specifications.

Circle 225 on Reader Service Card

HYDRAULIC CONTROL VALVES . . . for practically every requirement in hydraulic service, are presented in a brochure issued by Spenborough Engineering Co. Ltd., London, England. Line includes valves for turn control, two-way control, four-way control, group control and safety relief. Folder illustrates each type of valve and gives specifications and application information.

Circle 226 on Reader Service Card

Continued on page 150

Koppers 2-Piece Sealing Rings are installed on hot air shut-off valves manufactured for aircraft by Hydro-Aire, Inc. Ring inners are of stainless steel . . . ring outers are made of high chrome alloy heat resistant cast iron. Diameter is 1¾"

Koppers 2-Piece Rings Solve High Temperature Sealing Problems for Hydro-Aire

A Product of Continuous Research and Development by KOPPERS

To solve a sealing problem at high temperatures, Koppers engineers created a new sealing ring for Hydro-Aire, Inc.

Hydro-Aire, Inc. . . . a subsidiary of Crane Co. . . . manufactures hot air shut-off valves for aircraft applications. Ordinary rubber "O" rings couldn't withstand the high temperatures involved.

Koppers engineers designed a 2-Piece Sealing Ring with extremely close tolerances that provides maximum sealing at high temperatures. Primarily designed for aircraft applications, this new type ring can be used for sealing fuel oil and hydraulic oils as well as hot air and other gases.

The Hydro-Aire application is an interesting example of how highly trained Koppers engineers can solve customers' sealing problems. Koppers engineers in your area will be glad to study your applications and design the proper type of ring.

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To lower your production costs, bring your ring problems to Koppers. Write to KOPPERS COMPANY, INC., 1506 Hamburg Street, Baltimore 3, Maryland.

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Koppers Company, Inc., Metal Products Division
Piston Ring and Seal Department

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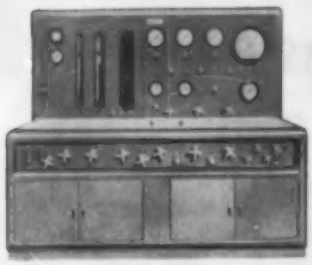

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For precise testing of airborne components and ground checkout of missile and aircraft systems.

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Useful Literature / continued

ENGINEERING HANDBOOK . . . on Teflon covers advanced useage in practical applications as a cushioning and insulating material for supporting clamps. Issued by TA Mfg. Corp., this 20 page handbook contains chemical, thermal, electrical and ageing properties as well as modern handling methods. Included is a tabulated chart covering 28 tests of the various physical properties of Teflon.

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KOPPERS®

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RING-TYPE SEALS

Koppers Company, Inc., Metal Products Division
Piston Ring and Seal Department

Engineered* Products Sold with *Service

Useful Literature continued

FLOW DIVIDER . . . permitting two simultaneous operations from one pump, has been developed by New Products Corp., Skokie, Ill. Bulletin explains the operation of the unit, giving details and operating information, and suggested applications. Unit operates on low circulation pressure, with any fluid, at any temperature, and divides the flow in any desired proportion. Performance of the main operation is not sacrificed because of secondary flow. When the pressure of the primary operation begins to build up, flow to the secondary operation begins to decrease.

Circle 227 on Reader Service Card

HYDRAULIC EQUIPMENT . . . produced by Century Hydraulics, Inc., Detroit, is described in their catalog. Covered in this booklet are: oil level sight gages, breather caps, filler-breather assemblies, clarifiers and reservoirs.

Circle 228 on Reader Service Card

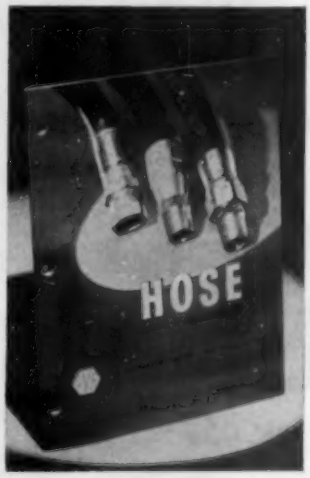
SPEED COUPLERS . . . and connectors for pneumatic service are described in bulletin available from Aro Equipment Corp., Bryan, Ohio. Units feature snap-on and snap-off connection, with swivel action to save hose wear. Folder gives complete data along with illustrations of the various types.

Circle 229 on Reader Service Card

AIR CONTROL VALVES . . . for every fluid power application, are featured in 70 page Catalog 57, available from Mechanical Air Controls, Inc., Detroit, Mich. Each valve is completely described, along with photo and schematic drawing. Line includes directional control, pressure control and sequence valves, with every type of operation, such as cam, foot and hand types, solenoid, pilot pressure and double pilot. Various mounting and porting arrangement are shown, along with a chart of typical installations.

Circle 230 on Reader Service Card

HOSE . . . and hose ends, manufactured by The Weatherhead Co., Fort Wayne, Ind., are covered in 40-page catalog. Over 180 elements are shown in easy-to-read form on special selection charts. Catalog gives complete and detailed information on bulk industrial hose, per-



manently attached hose assemblies, swaged hose assemblies and ends, hose end swivel adapters, assembly instructions and installation data.

Circle 231 on Reader Service Card

Check with LYNAIR FIRST!
ON YOUR AIR AND HYDRAULIC CYLINDER REQUIREMENTS

REGARDLESS OF YOUR NEEDS WE CAN SUPPLY THEM

Check these Advantages

- √ We engineer and manufacture Air and Hydraulic Cylinders for every application
- √ Cylinders meet J. I. C. standards
- √ Airdraulic cylinders for controlling feed in both directions
- √ New design Piston Packing assures minimum of bypass on hydraulic cylinders
- √ Complete range of sizes, 1½" bore through 8" bore, standard. Larger sizes on request.
- √ A full range of Air and Hydraulic Boosters.

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Circle 70 on Reader Service Card

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AIR EXHAUST MUFFLER

Silences NOISY BLASTS of AIR-OPERATED EQUIPMENT

Get rid of objectionable nerve-wracking noise. Install Atomuffler on the exhaust ports of your air-operated equipment.

Recommended by Safety Engineers, Labor Relations and Insurance Companies to eliminate annoying and harmful noise . . . Atomufflers are performance proven by years of everyday use on thousands of installations.

Atomuffler's Lateral-Radial Air flow principle is engineered to effectively eliminate noise and vapor mists. Used on all types of air-operated equipment, they are compactly designed with high air flow capacity—are easily installed—Low cost and available in ⅛" to 2" pipe sizes inclusive.

Representatives and dealers located in principal cities in United States and Canada.

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Circle 6 on Reader Service Card

SOLENOID COIL . . . featuring waterproof construction is described in Folder 210-3 issued by the Industrial Sales Division of Hays Mfg. Co. Coil is completely impregnated with a special epoxy resin under vacuum and electronically cured to produce a high-density, void-free casting. Unit is impervious to corrosive fumes, withstands abnormal physical shock and is unconditionally guaranteed. Chart giving specifications on units available is included in the folder.

Circle 232 on Reader Service Card

BUSWAY . . . manufactured by General Electric Co., Plainville, Conn., is described in a four-page Bulletin GEC-1446. Unit is a combination feeder, plug-in busway, rated from 600 to 4000 amps., 600 volts or less. Application and descriptive information are given, along with ratings, dimensions, operating characteristics, construction details.

Circle 233 on Reader Service Card

O-RINGS . . . are described in Catalog 9B, issued by Minnesota Rubber & Gasket Co. Fluid power engineers will be interested in a section of this catalog which shows schematically correct and incorrect installation of O-rings and the relative positions of the rings in different grooves at pressures from zero to 3000 psi. Also included are tables of dimensional data for installation of standard sizes of 0-ring packings.

Circle 234 on Reader Service Card

BUSHING ASSEMBLIES . . . heavy-duty, self-aligning type, are produced by Roller Bearing Company of America, West Trenton, N. J. Bulletin gives illustrations and descriptions of various applications of these bushing assemblies in mobile equipment, aircraft, industrial and stationary installations. Also included are tables of recommended assemblies and charts giving shaft and housing fits and clearances.

Circle 235 on Reader Service Card

HEAT EXCHANGERS . . . for hydraulic service, are described in Bulletin No. 170, available from Whitlock Mfg. Co., West Hartford, Conn. Folder gives complete engineering data and dimensional drawings for a wide range of models.

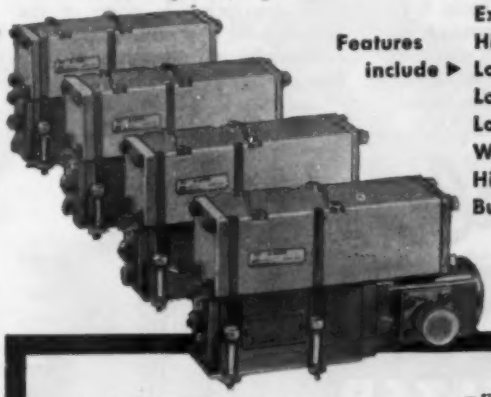
Circle 236 on Reader Service Card

Continued on next page

Now in mass production . . .

SANDERS SA-19 SERVO VALVE

The Sanders SA-19 Servo Valve provides unparalleled efficiency and reliability for a wide variety of electro-hydraulic components and systems. Utilizing the Sanders internal force feedback principle, this two-stage electro-hydraulic amplifier develops large hydraulic output flows with relatively low input electrical power requirements.



Features include ▶

- Excellent Resolution
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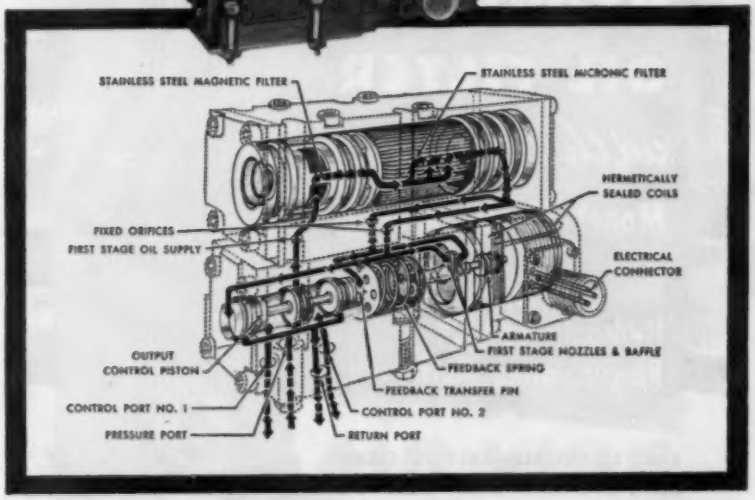

Operation: An input current, converted to a magnetic force in the First Stage Armature, moves the First Stage Baffle between two nozzles causing a pressure differential across the ends of the Output Control Piston. The resulting motion of the Output Control Piston is fed back through the Transfer Pin and Feedback Spring as a restoring force on the First Stage Armature, thus nulling the valve and porting oil to the load. The First Stage Oil Supply is thoroughly filtered as shown.

Typical Specifications The following are typical specifications for this valve. Higher pressure and higher frequency versions are also available.

Force Motor • Coil Resistance (ohms/coil) 400 • Differential Current ± 20 ma • Input Power 0.16 watts

Hydraulic Valve • Flow (GPM @ 1000 psi across valve) 10 • System Pressure (psi) 400 • Resolution (% of Full Signal) ± 0.125 • Hysteresis (% of Full Signal) ± 2.5

Write today for complete information.

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West Coast Field Office: 7335 VAN NUYS BLVD., VAN NUYS, CALIFORNIA, Tel. STATE 0-2720

Circle 107 on Reader Service Card

Useful Literature continued

FLOWMETER . . . measuring fluid flow under difficult conditions and at high temperatures and pressures, is discussed in Bulletin S-1 released by Potter Aeronautical Corp., Union, N. J. Design uses the hydraulic pressure of the measured fluid itself to suspend the turbine-type rotor in a floating position. Friction is eliminated and the rotor spins freely without slippage. Complete description is given of the operation of the unit, along with engineering information and specifications.

Circle 237 on Reader Service Card

Capital

HYDRAULIC OIL FILTER with Monel Metal Insert

Reservoir Type for Hydraulic and Oil Re-circulating Machinery

EASY TO INSTALL—EASY TO CLEAN
LONG LIFE—LOW COST—SIZES AND SCREENS TO FIT YOUR NEEDS

★ ONLY THREE PARTS
★ MEETS J.I.C. STANDARDS
★ GREATER FILTERING AREA
★ SPECIAL TRAP-WEAVE MESH

Specially woven MONEL wire cloth and a new method of compact corrugation, gives triple protection with less space than other filters of like capacity. Trap-weave mesh stops thin, elongated particles with NO loss of efficiency.

Non-corrosive, non-toxic materials throughout. Easily cleaned with an ordinary brush.

Write for descriptive circular.

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ELECTROMAGNETIC CONTROLS . . . including automatic transfer switches, remote control switches, magnetically held contractors, relays, and solenoids are described in seven catalogs from Automatic Switch Co. The complete information is contained in Catalog 57-S. In addition to detailed specifications on each component, a section of this catalog gives engineering information on operation and application of the equipment. Catalog 57-S5 on solenoids outlines the factors in selecting the proper solenoid, and compares a-c and d-c solenoids. Operating curves are shown for each type. Catalog 57-S4 devotes 42 pages to technical information on relays, selection factors, and specifications on magnetically held, mechanically held, and special units. The catalogs are available in separate or combined form by requesting on company letterhead.

HYDRAULIC EQUIPMENT . . . designed and built to requirements by Weinman Pump & Supply Co., Pittsburgh, Pa., is discussed in an 8-page brochure. Illustrations are given of equipment built for specific uses. Line includes valves, cylinders, filters, accumulators and allied hydraulic components.

Circle 238 on Reader Service Card

V-BELT TIPS . . . to prolong the life of V-belts and increase drive efficiency are contained in 12 page Bulletin 20X6234C of Allis-Chalmers Manufacturing Company. It describes various types of V-belts and tells how to select and match them and lists seven steps for correct installation.

Circle 239 on Reader Service Card

FLUID DRIVES . . . ranging from ⅛ to 15 hp, are available from The Master Electric Co., Dayton, Ohio. Drives can be furnished with any of their motors and gearmotors for a compact package. Bulletin gives details and specifications on their line of motors, gearmotors, unibrakes and fluid drives.

Circle 240 on Reader Service Card

CYLINDERS . . . for air or low pressure hydraulic applications are described in bulletin 157 of the Sheffer Corp. Their C 10 series cylinders are fully discussed, using illustrations, dimensional drawings and tables. Five different mountings are shown for the 150 psi air to 500 psi oil cylinders.

Circle 241 on Reader Service Card

Continued on page 154

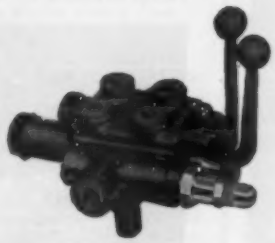
Circle 48 on Reader Service Card

Announcing—

A NEW GRESEN VALVE With FLOAT Position

GRESEN HYDRAULICS

A Two Spool Directional Control With Float



FEATURES: Detent in Float Position—Self Centering From Power Positions—Fully Balanced—Relief Valve Has Replaceable Hardened Seat—Tripod Mounting Feet—Smooth Positive Throttling Action—Hardened and Chrome Plated Spools.

SPECIFICATIONS: Capacity 20 GPM (at 20 Ft/seconds)—Maximum Pressure 1500 PSI—Parallel Application—Shipping Weight 22-1/2 Lbs.

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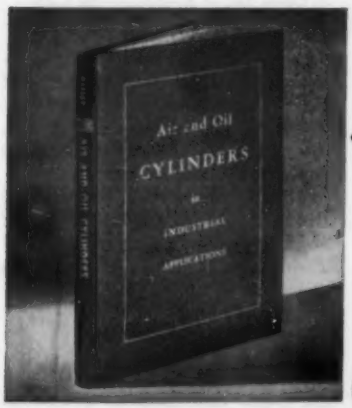
GRESEN MANUFACTURING CO.

628 Colfax Ave. N. Dept. H-67 Minneapolis 11, Minn.



AIR & OIL CYLINDERS

Elmer Heiser has written this valuable cylinder handbook which tells about types, cushions, how to order, proper porting, correct sizing, packings, and efficient installation methods.

It's full of application ideas.

PRICE $5.00

The Industrial Publishing Corporation

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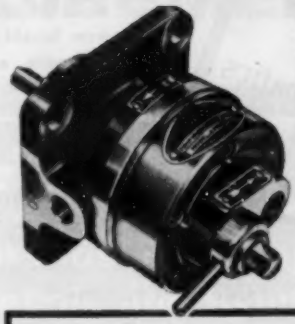
Circle 108 on Reader Service Card

SAVERY ANNULAR PISTON PUMP



Infinitely variable from maximum output down to zero. Working pressures up to 1500 p.s.i. Fixed delivery models also available.

This compact rotary pump without Gears, Valves, Vanes or Springs is of unique design and simple in construction.

The pump has the following desirable characteristics:

- Volumetric efficiency as high as 99%
- Absolute positive action and steady uniform flow at slow speeds
- No aeration or turbulence of the fluid
- The path of the fluid through the pump is unidirectional and the internals are constantly swept by the fluid
- No idle pockets or passages to cause air locks or allow coagulation
- Completely self-lubricating, ensuring capacity to run for long periods without attention
- Leakproof

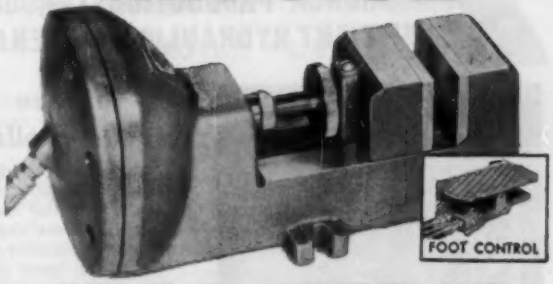
U. S. and CANADIAN AGENT

DAVIES BROS., GLADSTONE, NEW JERSEY

Thomas Savery Pumps Ltd., Birmingham, England

Speedy

AIR VISE



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SPEEDY 1-TON AIR PRESS

Does the work of expensive presses! Power factor 15 times air line pressure. 5-inch throat; Ram 0 to 5"; stroke 5/8"; table 5" x 5". Operated by foot or fingertip controls. **$85.00**

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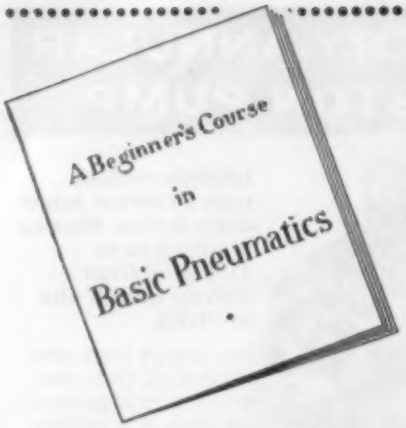
W. R. BROWN CORP., 2655 N. Normandy Ave., Chicago 35

AIR TOOLS • AIR VISES • AIR REGULATORS • FILTERS • LUBRICATORS



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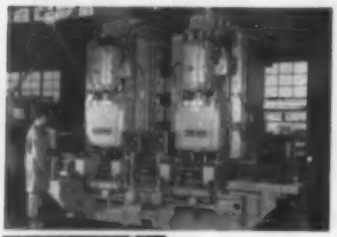
HIGHER PRODUCTION THROUGH EFFICIENT HYDRAULIC MAINTENANCE



free manual tells how

RELIABLE MACHINE BUILDERS LIKE SUNDSTRAND AND MACHINE USERS, LARGE AND SMALL FIND that low cost filters placed in the correct locations step up production. Sticking valves, stuck spindles and corrosion troubles are reduced to lowest minimum. Operators find their work goes smoother. Cuts "down-time" AND SLOW TIME costs.

Briggs — PIONEERS IN MODERN OIL FILTRATION

HYDRAULIC OIL FILTERS

PRODUCT OF RESEARCH

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DEPT. 177, WASHINGTON 16, D. C.
YES! Send me your complete hydraulic production manual.
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COMPANY .....
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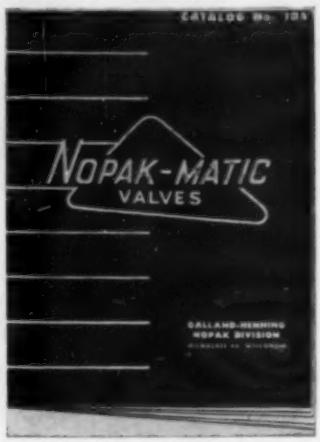
Useful Literature — continued

AIR CONTROL VALVES . . . pilot-operated, poppet-type, are manufactured by Galland-Henning Nopak Division, Milwaukee, Wis. Valves available for 2, 3 and 4-way



operation, with air single or double-solenoid pilot control, are described in 16-page Catalog 105. Booklet contains complete dimension, installation, application and operation data in convenient form.

Circle 242 on Reader Service Card

AIR & OIL CYLINDERS . . . featuring rod cartridge assembly for easy maintenance, are manufactured by Teer-Wickwire & Co., Jackson, Mich. Bulletin S-101 gives complete technical data and schematic and dimensional drawings of the various models. Fluid power engineers will be interested in the 27-point check list of items to watch in specifying cylinders.

Circle 243 on Reader Service Card

AC ROTARY SOLENOIDS . . . are described in a bulletin issued by Leetronics, Inc., Brooklyn, N. Y. Units feature operation on standard ac voltage, in any position, vibration and shock-proof, rotary motion without axial shift, precise movement. Folder gives specifications, engineering information, illustrations and sketches of the various units, along with graphs giving torque vs rotary stroke.

Circle 244 on Reader Service Card

HYDRAULIC COMPONENTS . . . available from Palley Supply Co., Los Angeles, are illustrated and described in their 32-page catalog.

Included are: cylinders of various types and mountings, special purpose cylinders; control, relief, check and needle valves; filters, motor-driven and hand pumps; fluid motors; power units; accumulators; hose and fittings. A section of the catalog gives general hydraulic engineering information and formulae, with sketches of circuits.

Circle 245 on Reader Service Card

FILTER INFORMATION . . . including specifications of hydraulic oils, methods of installing filters, is given in bulletin available from Briggs Filtration Co., Washington, D.C. Data given should be of interest to fluid power engineers working on filtration problems. Circuit diagrams are also given showing proper location of the filters.

Circle 246 on Reader Service Card

PUNCH-LOK MANUAL . . . describes in detail application and method of using Punch-Lok clamps. Fluid power engineers will be interested in the applications using this clamping method on various types of hose assemblies and connections. Also included in the 12-page booklet available from Punch-Lok Co., Chicago, are the standard-type hose clamps, grooved hose fittings, special tools and replacement parts.

Circle 247 on Reader Service Card

BOOSTER and ACCUMULATORS . . . manufactured by Petch Mfg. Co., Alpena, Mich., are covered in Catalog B-54. Four pages of circuit diagrams are given, showing air-hydraulic units, self-bleeding system, and various arrangements of air and oil cylinders and boosters. A booster selector chart is given, along with engineering information and specifications on the line of boosters, accumulators, tanks and air hydraulic units.

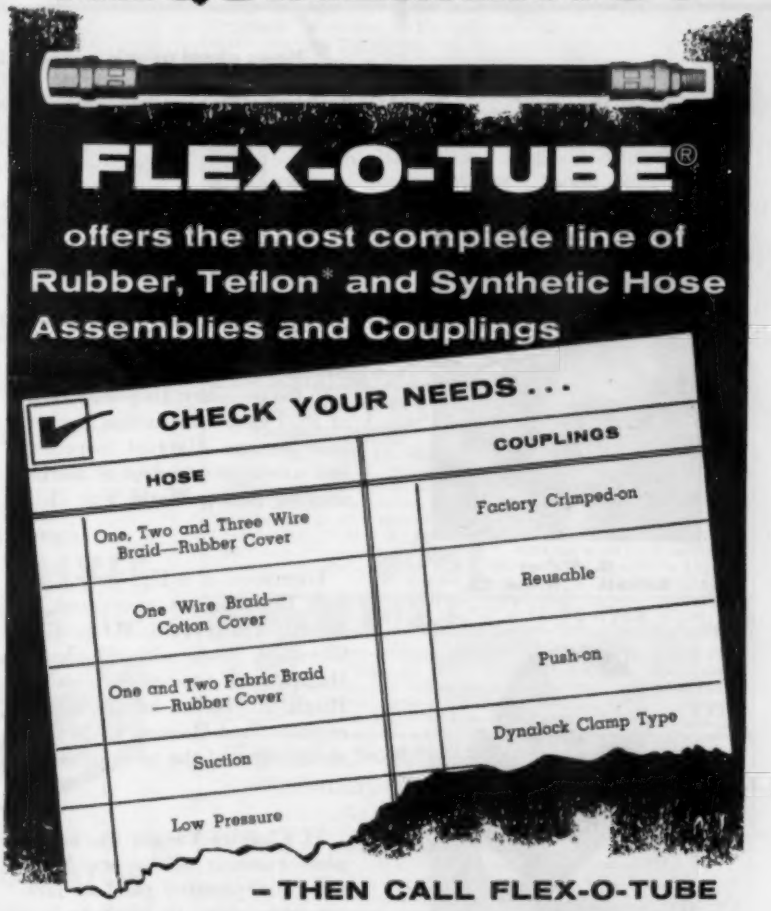
Circle 248 on Reader Service Card

HYDRAULIC CYLINDERS . . . are the subject of Vickers Incorporated Bulletin 57-68, which shows recent improvements in design and additional mountings for their "compact" hydraulic cylinders. The bulletin provides information on the construction and features of their 2000 psi cylinders. Tables of sizes and dimensions and useful engineering data are also included.

Circle 249 on Reader Service Card

What are your

HYDRAULIC HOSE REQUIREMENTS?



—THEN CALL FLEX-O-TUBE

At Flex-O-Tube you'll find the finest and most complete selection of hydraulic system components . . . all manufactured of top quality materials. The inner tube of Flex-O-Tube hose is composed of a seamless synthetic compound resistant to petroleum products, common hydraulic fluids, water and air. A wide variety of reinforcement and outer covering combinations are available.

Flex-O-Tube offers four kinds of fittings and couplings. (See chart above.) These are available in all standard connecting types.

Remember, for all your hydraulic hose and coupling requirements —write or phone Flex-O-Tube First!

When your requirements call for metal, specify Flexon Flexible Metal Hose, available in a complete range of sizes and types.

*Du Pont Trademark

H-6

FLEXON® QUALITY
proved in service and backed by over 55 years manufacturing experience

Flexonics Corporation
FLEX-O-TUBE DIVISION
1386 S. THIRD AVENUE, MAYWOOD, ILLINOIS
FORMERLY CHICAGO METAL HOSE CORPORATION
Manufacturers of flexible metal hose and conduit, expansion joints, metallic bellows and assemblies of these components.
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Circle 122 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

M. Nielsen
Babcock & Wilcox Co.

M. Nielsen is the new president of **Babcock & Wilcox Co.** For the past two years executive vice president, Nielsen succeeds Alfred Iddles, who is retiring after serving as president since 1948. Nielsen has 33 years experience with the company. He joined B&W in 1924 as a construction worker, later became district inspector, and was superintendent of marine erection during World War II.

H. Charles Yaeger,
Vickers Incorporated

Formation of a Hydraulic Controls Division was announced by **North American Mfg. Co.,** Cleveland, Ohio with **Clark E. Hague** as director of engineering, **Hugh N. Helm** as application engineer, and **Harvey E. Neville** as manager of the new division.

H. Charles Yaeger was named plant manager of the new **Vickers Incorporated** plant at Jackson, Mississippi. He has been associated with the aircraft industry for 20 years.

Donald C. Campbell
Skinner Chuck Co.

Joseph T. Ryerson & Son, Inc. has appointed **Milton C. Fidgeon** assistant sales manager of its New York area steel service plant. Fidgeon is a veteran of 40 years service with the company.

Donald C. Campbell was appointed works manager of **Skinner Chuck Co.,** New Britain, Connecticut. Campbell will be responsible for manufacturing operations in the chuck and electric valve divisions.

General Bearing Co., Inc., Mineola, New York, announced the appointment of **Milton P. Gussack** as national sales manager for their commercial bearing and allied lines.

M. J. McCaughey was appointed regional sales manager of the **Tuthill Pump Company,** Chicago, Illinois. McCaughey has charge of Tuthill's sales organization in Wisconsin, northern Illinois, southern Iowa, Minnesota, and eastern Missouri.

Hannifin Corporation, Des Plaines, Illinois is expanding its Philadelphia sales office to serve a wider area. Latest addition is **James P. Mockler,** who will serve the Lancaster-York area and most of Maryland.

Charles Bodey has joined **Southwestern Industries Inc.** as Chief Engineer. Prior to joining Southwestern, Bodey was assistant to the vice-president of research at Standard Coil Products, Los Angeles.

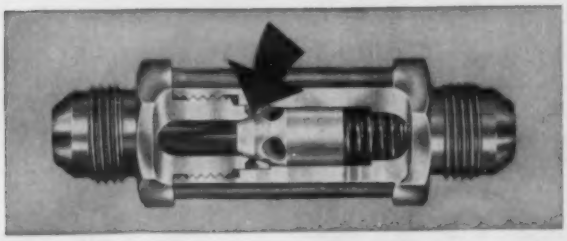
Edward V. Huda has been named director of research and development for the adhesives department of **Raybestos-Manhattan, Inc.,** Bridgeport, Conn. He has been with the research and product development department of the Raybestos Division since 1946.

Continued on page 158

Circle 63 on Reader Service Card

Simple, Secure . . . Leak-Tight!

The FLEXIBLE SEAL SEAT*



Responsive action of the soft O-ring seal provides absolute leak-tightness. Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts; no extra end seals. Stocked in 6 standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Write for data sheet.

KEPNER PRODUCTS COMPANY
7321 West 59th Street • Summit, Illinois

Kep-O-seal

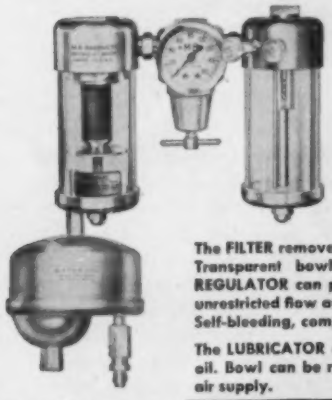
HYDRAULIC & PNEUMATIC
CHECK VALVES

* PATENT APPLIED FOR

GREATER PROTECTION to Your AIR LINE!

M·B

WHIRL-A-WAY FILTER, REGULATOR AND LUBRICATOR ASSEMBLY AND AUTOMATIC AIR TRAP (MODEL W-4)



SUCCESSFULLY USED FOR PROTECTION OF AIR VALVES CYLINDERS CONTROLS PNEUMATIC TOOLS, ETC.

The FILTER removes solids .00039 and larger. Transparent bowl provides visibility. The REGULATOR can pass large volume with an unrestricted flow and minimum pressure drop. Self-bleeding, compact.

The LUBRICATOR delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

The Air Trap is automatic and eliminates manual draining.

M·B PRODUCTS
46 VICTOR AVE., Div. 10
DETROIT 3, MICHIGAN

Palley's SAVE YOU UP TO 85%

on HYDRAULIC CYLINDERS - VALVES - PUMPS - PARTS, etc. . .

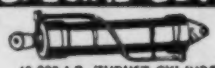
OVER 10 YEARS EXPERIENCE in filling the needs of Aircraft and Heavy Industry led to the development of our own line of outstanding INDUSTRIAL HYDRAULIC CYLINDERS and supplies. We also carry one of the largest stocks of GENUINE GOV'T SURPLUS CYLINDERS, VALVES, PUMPS, MOTORS and Accessories. What we cannot supply we will CUSTOM MANUFACTURE to YOUR specifications.

NEW Palley HYDRAULIC CYLINDERS

All are Double Action with rugged steel construction throughout. Made to stand pressures up to 1500 PSI and 3000 PSI. Utilizes standard 'O' rings in all models and has leather back-up rings in the 3000 PSI types.

PART NO.	BORE	STROKE	SHAFT	P.S.I.	PRICE
P3-4-15E	3"	4"	1-1/8"	1500	$34.25
P-6-15E	3"	6"	1-1/8"	1500	36.75
P3-12-15E	3"	12"	1-1/8"	1500	44.75
P4-5-15E	4"	5"	1-1/8"	1500	39.50
P4-8-15E	4"	8"	1-1/8"	1500	45.75
P4-5-30E	4"	5"	1-1/2"	3000	55.25
P4-8-30E	4"	8"	1-1/2"	3000	61.50
P4-12-30E	4"	12"	1-1/2"	3000	69.75
P5-12-30-1	5"	12"	2"	3000	85.00
P5-24-30-1	5"	24"	2"	3000	115.00

SPECIAL GOV'T SURPLUS HYDRAULICS



40,000 LB. THRUST CYLINDER
A GOV'T SURPLUS BARGAIN! Produces up to 40,000 lb. thrust with a 3000 PSI line pressure. May also be used as a low pressure air cylinder. Has 4" bore, 18" stroke. 30½" long. Navy overhauled – LIKE NEW – **49.95**

VICKERS PISTON TYPE PUMPS
Made to top Aircraft specifications. RPM given below is recommended for constant speed.

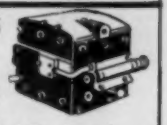
PF9-713-20BCE – Delivers 5.3 GPM at 1000 PSI at 3000 RPM – USED $20.00
PF9-2713-10Z – Delivers 2.7 GPM at 1500 PSI at 3000 RPM – USED $22.50

VICKERS HYDRAULIC MOTOR
MF9-713-25BCF–Operates on 8.25 GPM at 1000 PSI at 3750 RPM–USED $22.50

2 GPM STRATO POWER PUMP

Positive displacement type. Capacity of 2 GPM at 1400 PSI. Displaces .450 cu. in. per revolution at 3750 RPM in either direction of rotation. Intermittent maximum RPM – 4500. Has a built-in, variable flow control valve in head. Piston type. 1 inch internal pipe ports. **Now 27.50**

SPECIAL SURPLUS VICKERS HYDRAULIC TRANSMISSION



Self-contained, constant torque at all speeds with variable volume, reversible piston pump which supplies hydraulic motor. Has 2 H.P. automatic dash pot for smooth pressure control. Power output is 0 to 1/3 of the input RPM in both directions of rotation. Input RPM is 1800 continuous and up to 4000 intermittent. This is an excellent unit for the operation of Lathes, Duplicator Set-ups, Conveyors, Drives of all types, etc. **ONLY 49.50**

INPUT & TAKE-OFF PLATE ASSEMBLIES
These units permit the adaptation of a pulley input and take-off for the transmission above. They have high speed bearings and 1/2" diameter, shaft with keyway. Easily installed. **10.50 EACH**

4-INCH SPLINE SHAFTS Made to fit the input and take-off shafts of the transmisson above. Permits use of gear or pulley drives. **1.25 EA.**

SOON TO BE RELEASED!! 396 PAGE – 1957 CATALOG

IT WILL SOON BE OFF THE PRESSES! IT'S PACKED from COVER to COVER WITH THE MOST FANTASTIC ARRAY OF BARGAINS IN PALLEY'S HISTORY!

Thousands upon thousands of industrial, Commercial and Consumer items at GREATER SAVINGS than ever before! Tools, Supplies and Equipment in Hydraulic, Electrical, Mechanical and Building lines. Aircraft Parts and Supplies. Electric Motors, Generators and Portable Power Plants. Pumps of every description. Power Tools and so many more items it takes 396 PAGES to completely show them all. WATCH THIS AD FOR ANNOUNCEMENT OF THE PUBLICATION DATE!

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Los Angeles 58, California

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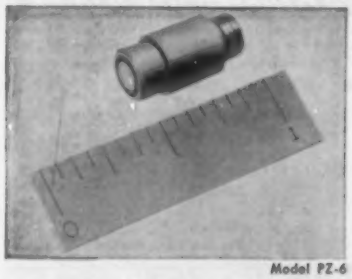
Model PZ-14



Model PZ-6

Kistler SLM Transducers measure combustion, detonation, hydraulic and pneumatic pressures precisely

Featuring extreme ruggedness, high sensitivity and fast response, the precision, Swiss-made SLM Pressure Transducers permit direct measurements of *pressure* and *rate* of pressure changes.

Providing continuous operation at steady temperatures up to 600° F, with intermittent gas temperatures on the diaphragm to above 3000° F, they give faithful response to fast or slow pressure variations in shock tubes, gun tubes, rocket motors, rocket sleds, aerodynamic models, gas turbines, diesel and gasoline engines, compressors, fuel pumps, hydraulic and pneumatic control systems.

Calibration is constant and practically independent of temperature. This is the only commercially available crystal type instrument that can be calibrated by conventional static methods.

Pressure changes generating an electrical charge in the pickup are measured by an electrostatic type Kistler amplifier and displayed on an oscilloscope. Voltage signals are about 1000 times higher than from a typical strain gage or inductive type instrument. The standard Model PZ-14 Transducer covers all pressure ranges from 0.1 psi to 3000 psi and measures full vacuum. A Kistler pickup adaptor extends this range to 30,000 psi. Response time is 15 microseconds, resolution .01 psi with linearity and repeatability better than 1% of the pressure being measured. Designed for relatively "hard-to-get-at" locations, the Sub-Miniature Model PZ-6 Transducer achieves response times to one microsecond. A new electrostatic feedback amplifier is available for use with this type pickup.

The SLM Pressure Pickup, combined with special low-noise cables and a Kistler Piezo-Calibrator-Amplifier (required to couple pickups to oscilloscopes or recorders) constitutes the Kistler SLM Pressure Indicator. For complete information, request Bulletins PI-114, PZ-14 and PZ-6.

Kistler Instrument Corp., Dept. AH, 15 Webster St., North Tonawanda, N. Y.

Post Scripts of Industry

continued

Cross Mfg. Co., Lewis, Kansas has established a separate industrial hydraulics division. **Cecil Kazmaier** was appointed manager of the new division. Kazmaier was general manager prior to his appointment.

Cecil Kazmaier
Cross Mfg. Co.

Four new distributors for **Flodar Corp.** have been announced. They are: **Specialty Sales Co.,** Salt Lake City for Utah; **Hydraulic Service & Supply Co.,** Denver for Colorado; and **Standard Equipment Co.,** Seattle, to cover Washington and Oregon. In Canada, **Higginson Engineering** of Hamilton will cover the province of Ontario.

James D. Evans and **Arden B. Moldstad** have been named field representatives for **Republic Rubber Division, Lee Rubber and Tire Corp.** Evans has his headquarters in New Orleans and supervises sales in Mississippi, Louisiana, and Alabama. Moldstad is responsible for the New England area. His offices are in Boston.

Louis Shaffer was named purchasing agent for the **Marman Division, Aeroquip Corp.** Shaffer has been associated with Marman since 1948. Before his appointment he was customer service manager.

Calpacific Equipment Co., San Francisco has been appointed northern and central California representative for **Sprague Engineering Corp.,** Gardena, California.

Midcontinent Tube Service, Inc., 2308 Oakton St., Evanston, Ill. appointed **Harold Michel** and **Cyril M. Rappaport** to its executive staff. Michel has had many years experience in the marketing of steel products. Rappaport was a management consultant prior to his appointment.

Hydraulic Press Mfg. Co., Division of Koehring Co., Mount Gilead, Ohio announced the following promotions: **William J. Fath** to works manager and **Warren E. Beck** to production control manager. **A. L. Wallace** became assistant production control manager.

William J. Fath
Hydraulic Press Mfg. Co.

Allen Manufacturing Company began construction of a new plant and main offices in Bloomfield, Conn. on April 1st. Allen expects to move its equipment and 700 employees into the plant about August 1, 1958. The new structure will be of modern, one-story construction, covering in excess of 250,000 square feet, with an additional 20,000 square feet of office space, and ample room for expansion.

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1	18	35	52	69	86	103	120	137	154	171	188	205	222	239	256	273	290	307	324
2	19	36	53	70	87	104	121	138	155	172	189	206	223	240	257	274	291	308	325
3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292	309	326
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

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3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292	309	326
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

John H. Briggs, has been appointed district sales manager for the machine tool division, **Brown & Sharpe Mfg. Co.,** Providence, R. I. **Robert E. Berger** has been named district sales manager for the company's industrial products division.

Walter J. Beyer has been promoted to manager of engineering, **Perfex Corporation,** Milwaukee. He has charge of engineering and inspection functions, cost reduction, and new products. **Robert G. Jensen** has been promoted to the position of chief engineer formerly held by Beyer.

Walter J. Beyer, Perfex Corporation

Norman G. Burkhardt, San Francisco, has been named western sales engineer for the rubber products division, **Parker Appliance Company,** Cleveland. His area includes northern California, Nevada, Utah, Colorado, New Mexico, and Arizona. **Bearing Sales Service, Inc.,** 1645 N. W. Hoyt St., Portland, Oregon, and 2906 Sixth Ave. So., Seattle was appointed distributor of Parker products. **Dave N. Allensworth** was made sales head of Parker industrial tube and hose fittings in the Los Angeles district, including Nevada, Utah, Colorado, New Mexico and Arizona. **George C. Stephens** was named sales engineer for Parker tube and hose fittings in the Chicago district, and will cover northern Illinois.

Walter H. Feldmann was elected president of the **Worthington Corp.,** Harrison, N.J. He succeeded **Edwin J. Schwanhausser,** who became vice-chairman of the board. Feldmann has been associated with Worthington since 1944, Schwenhausser since 1915.

Walther H. Feldmann Worthington Corp.

H. S. Cain has been appointed district sales engineer for **Berry Hydraulics,** a division of **Oliver Tyrone Corp.** Cain will be responsible for the Texas sales territory. He will headquarter at 4046 Lemac St., Houston.

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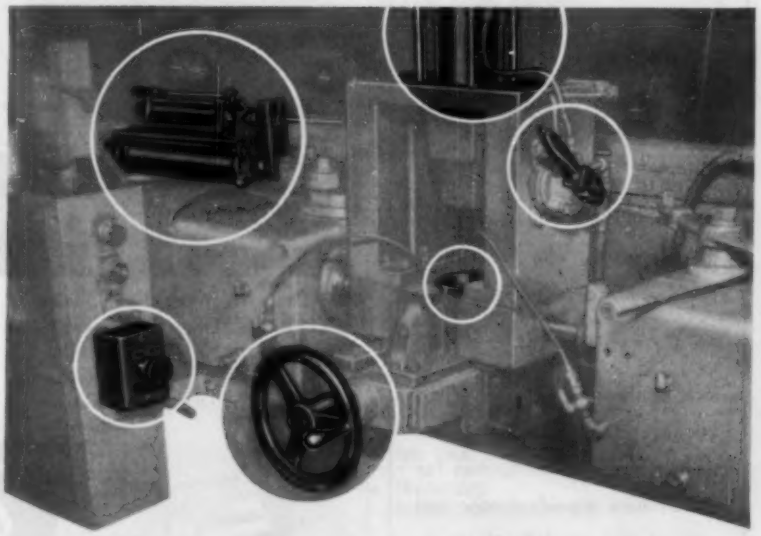
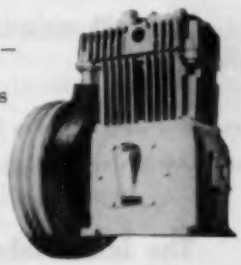


COMPRESSED AIR
accurately locates and drills pistons on this machine

LOW-COST AIR POWER supplied by a Quincy Compressor pays this manufacturer in speed, precision and actual dollar savings. Piston to be drilled for piston pin is placed in fixture, valve at right is opened, and air cylinder at top moves locating tool down into position. Piston is then clamped for drilling with a quick turn of the wheel at front. Switch at operator's left actuates horizontal air cylinders which feed drills through piston pin holes, return them automatically.

Complicated set-ups and simple ones, long production runs and short ones,— all can employ low-cost air power to advantage. Quincy makes compressors for industry from 1 to 90 C.F.M. For help with your compressed air applications in machines and manufacturing, address Dept. AH-67.



Quincy COMPRESSORS

QUINCY COMPRESSOR CO. • QUINCY, ILLINOIS

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With the opening of our permanently staffed Rome office we are now able to give marketing help to American manufacturers who are interested in any of the above three areas.

We opened our Italian office because that country offers unusual profit opportunities for American manufacturers and without the usual foreign currency limitations. The Italian government makes it very attractive to American manufacturers who will open certain types of plants in specified locations. Such manufacturers get favorable tax consideration and are able, under most circumstances, to take their profits out of Italy with minimal limitations.

Drop us a note if you're interested. Att: Irving B. Hexter.

The Industrial Publishing Corporation

812 Huron Rd. ● Cleveland 15, Ohio

Post Scripts of Industry continued

Appointment of **A. W. Root** as applications engineer, controls sales section, of **Fulton Sylphon Division** of **Robertshaw-Fulton Controls Co.**, has been announced. Root formerly served on the sales staff of the company's **Fielden Instrument Division.**

The aero hydraulics division of **Vickers Incorporated** has moved from El Segundo, California to a new plant in Torrance, California. The new 100,000 sq. ft. facility will accommodate engineering, sales, service, and production of aircraft, missile and engine hydraulics systems and components.

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Three heavy-duty CROSS Hydraulic Cylinders provide power and control, on this rugged loader . . . built by GECO, INC., Denver, Colo. For long-lasting, leak-proof dependability . . . you can rely on CROSS CYLINDERS in any operation!

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Minnesota Rubber and Gasket Company bought General Industrial Products Co., Inc., and will operate the firm as a division of Minnesota Rubber. The new division, **Minnesota Latex Rubber Company,** will include the original company's two plants in Minneapolis. Walter Craig, president of General Industrial Products, will continue to direct operations as general manager of the new division. Expansion plans include a new plant adjacent to the present facilities. Sales and administrative offices for the new facility are located at Minnesota Rubber headquarters, Minneapolis.

H. Perry Smith has joined **Associated Spring Corporation,** Bristol, Conn., as assistant director of research. Smith will be at the research center in Bristol, where he will be directly in charge of the research and product development program.

Belmont Packing and Rubber Co., Philadelphia, has announced the appointment of **John W. Russell** as field sales manager. Russell was previously eastern sales manager for Periflex, Inc.

John W. Russell,
Belmont Packing and Rubber Co.

Harry M. Cook has been named manager of industry sales of **Clark Controller Co.,** Cleveland, Ohio. He replaces **W. R. Heckman** who was named assistant manager of operations for the company.

Continued on next page

Advanced Filtration

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LINE TYPE
MAGNETIC FILTER HOUSING
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EDGE-TYPE, WIRE-WOUND, SCREEN, FIBER CARTRIDGE and POROUS METAL FILTERS

Filtration Engineers *In Principal Cities*

Post Scripts of Industry continued

Julius Kendall was named vice president in charge of sales of **Arkwin Industries, Inc.**, Westbury, N.Y. He was formerly with Greer Hydraulics Inc. as research and development division vice president.

Julius Kendall
Arkwin Industries, Inc.

Ditzen Engineering & Sales Co., northern California representative for **Rivett,** has moved to 6002 Telegraph Ave., Oakland, Calif. Floor space is increased four times, and office personnel doubled, enabling the company to better handle customer needs.

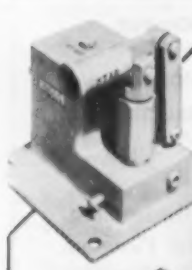
M. J. Kennedy has been appointed assistant general manager of the Skinner division of **Bendix Aviation Corp.**, Troy, N.Y. He was formerly managing director of Renfrew Electric and Refrigerator Co.

L & L Mfg. Co., East Detroit, has named **Washburn-Garfield Co.**, 169 Commercial St., Worchester, Mass. their stocking distributor in that area.

William S. Stamp has been promoted to district manager, Buffalo area, by **Clark Controller Co.**, Cleveland. Stamp has served in various capacities with Clark since 1946.

William S. Stamp
Clark Controller Co.

An expanded program of valve research and development has been started by **Rockwell Mfg. Co.** meter and valve division. The program will be in a new valve laboratory, double the original area, which has been equipped for extended prototype proving.



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SINGLE PISTON
HYDRAULIC PUMP

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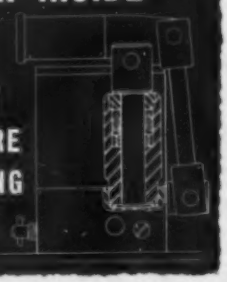

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- Spring loaded multiple chevron piston packings for lifelong service.
- All pistons chromium-plated to guard against abrasions.
- SAFETY BY-PASS VALVE to prevent overload dangers.
- Gauge opening.
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- ½", ¾" or 1" pistons with 1½" stroke.
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STOPS PIPE THREAD LEAKAGE
without specifying straight thread

- Use with standard tapered female pipe threads
- No special tools required
- Tube end utilizes standard 37° Flare fitting elements
- RING-WEDGE male thread slotted allowing O-ring seal contact independent of port thread depth
- O-ring does not interfere with threads
- O-ring seals on port boss-spot face optional—no pipe sealing compound required

Part No.	Tube O.D.	Used w/ NPTF
821RW 4	¼"	⅛"
821RW 6	⅜"	¼"
821RW 6-6	⅜"	⅜"
821RW 8-4	½"	¼"
821RW 8	½"	⅜"
821RW 8-8	½"	½"
821RW 8-12	½"	¾"
821RW 10	⅝"	½"
821RW 12	¾"	⅜"
821RW 14	⅞"	¾"
821RW 16	1"	1"
821RW 20	1¼"	1¼"
821RW 24	1½"	1½"
821RW 32	2"	2"

Send for complete information

PETCH
SALES—463 York, Detroit 2
MANUFACTURING COMPANY

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Circle 92 on Reader Service Card

Pesco Products Division, Borg-Warner Corp., is now exclusively devoted to engineering and production of aircraft accessories. This became possible when the former industrial division at Pesco became a separate Borg-Warner facility, the **Wooster Division,** Wooster, Ohio.

H. Merle Hanford has been appointed manager of the air-hydraulic division of the **R. C. Neal Co.,** Buffalo. Hanford will make his headquarters in the Rochester office of the company. His appointment follows the company's decision to put a new emphasis on their air-hydraulic operations to meet the growing demand for such products.

H. Merle Hanford
R. C. Neal Co.

Arthur W. Tibbetts has been appointed general manager of **Hydralink Corp.,** Hazel Park, Mich. The announcement was made by Robert E. Day, president of the corporation. Tibbetts was formerly sales manager of The Condamatic Co., Inc.

Arthur W. Tibbetts,
Hydralink Corp.

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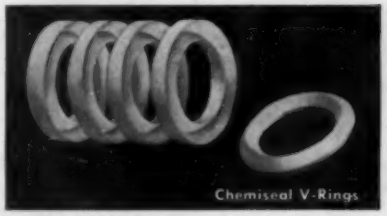
CHEMISEAL PACKINGS PROVIDE

the RELIABILITY of TEFLON



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United States Gasket *Plastics Division*
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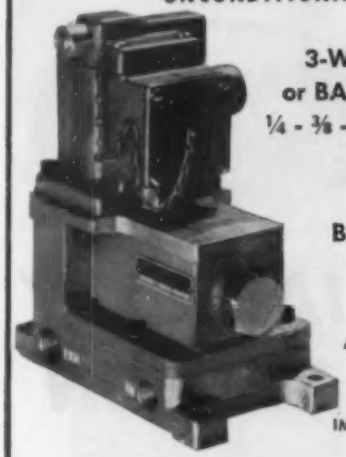

3-WAY IN-LINE or BASE MOUNTED
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4-WAY BASE MOUNTED
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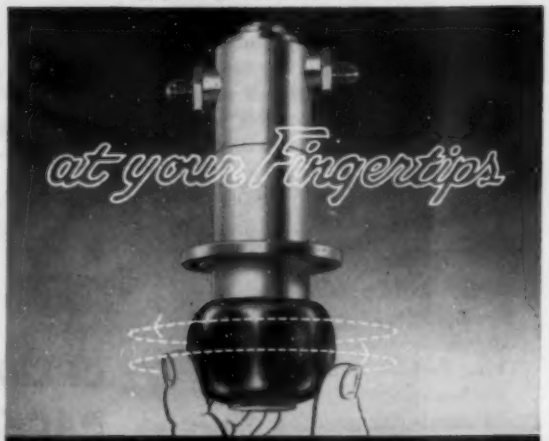

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Port Size	¼" tube per AND 10056
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Flow	Exceeds any other loader available
Operating Temperatures	— 65° to + 250°F
Weight	2½ pounds

NOW.....YOU CAN DIVIDE HYDRAULIC FORCE WITHOUT SACRIFICING PERFORMANCE ON YOUR MAIN OPERATION!

Now, for the first time, manufacturers operating equipment hydraulically have practically full control of the division of hydraulic force. The New Products Flow Divider will divide hydraulic force without sacrificing performance of your main operation because of secondary flow as with ordinary flow dividers.

This means, for instance, that on fork trucks no power in lifting will be sacrificed to power steering.

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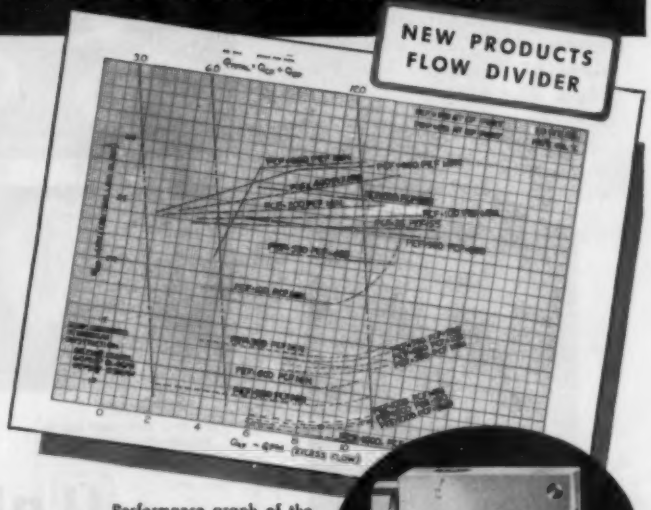
The New Products Flow Divider is simple, easy to install. It operates on low circulation pressure and it eliminates extra pumps. It is compact in design and quiet in operation and it is built to precision standards of the finest materials.

A new folder is available that describes its operation in detail and sums up its advantages. You should have it. It will be gladly sent on request.



Performance graph of the New Products Flow Divider. The valve is illustrated to the right.

Pat. Pend.

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Phone: ORchard 3-5873

Post Scripts of Industry
continued

Appointment of **W. J. Rutherford** as aviation sales manager was announced by **General Logistics,** Pasadena, a subsidiary of **Aeroquip Corp.,** Jackson, Michigan. He was formerly their western states chief sales engineer.

W. J. Rutherford, General Logistics

The appointment of **Charles Binge** as acting manufacturing manager of the Kalamazoo division has been announced by **New York Air Brake Co.** Binge has been associated with the company for a number of years, most recently as chief industrial engineer at the Watertown, N.Y. division.

Charles Binge, New York Air Brake Co.

Richard A. Geuder was named general manager—marketing, and **Carl V. Gregory** became sales manager of the **Reliance Electric & Engineering Co.,** Cleveland, Ohio. Geuder has been general sales manager for the past year, and Gregory has been manager of district sales since 1954.

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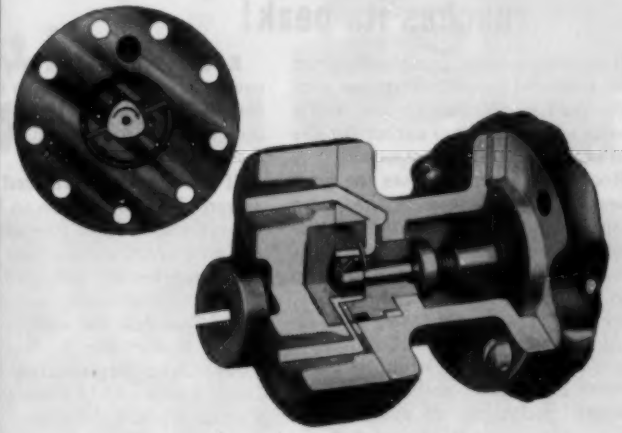
Positive Displacement Rotor Type. For Industrial Applications, Aircraft Anti-Icing and Aircraft Fuel.



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The rotation of the rotor draws the fluid in through two passages, filling the cavities formed by the three lobes of the rotor. This fluid is sealed within these small cavities until it is forced through the two outlet holes by the floating blades. The flow may be kept uniformly divided through two outlet ports, or may be combined internally for passage through a single port.

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Rocket Engineering offers the most interesting opportunities in the pump engineering field today. Your experience with commercial pumps and compressors will be extremely useful—to help solve problems of head capacity, power and speed never before encountered. You'll gain technical and professional experience that is unobtainable elsewhere... your contributions to the advanced techniques of pump design will be recognized and rewarded.

Rocketdyne builds high thrust, rocket propulsion systems for America's major missiles. You'll work with the leading producer in the nation's fastest growing industry.

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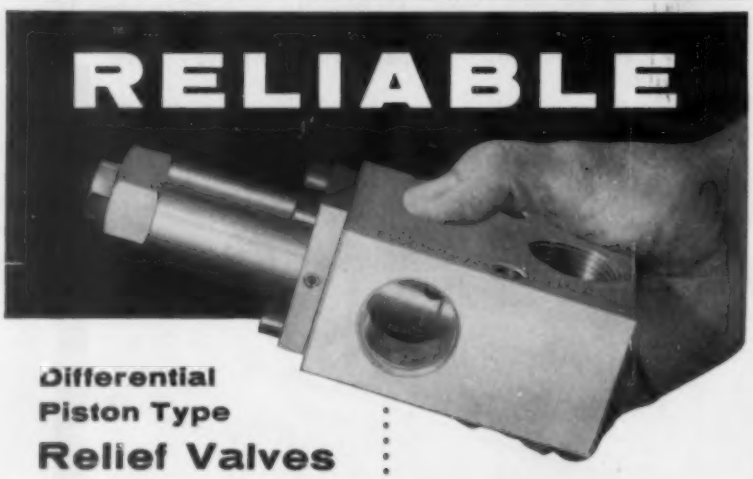
BUILDERS OF POWER FOR OUTER SPACE



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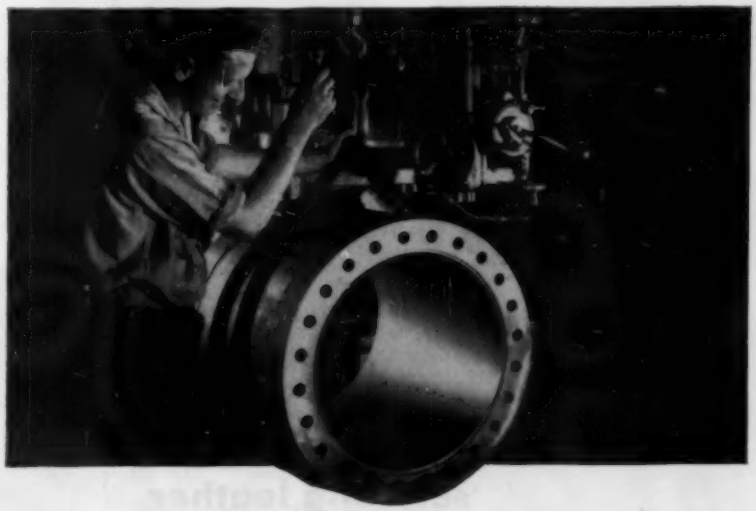

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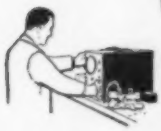

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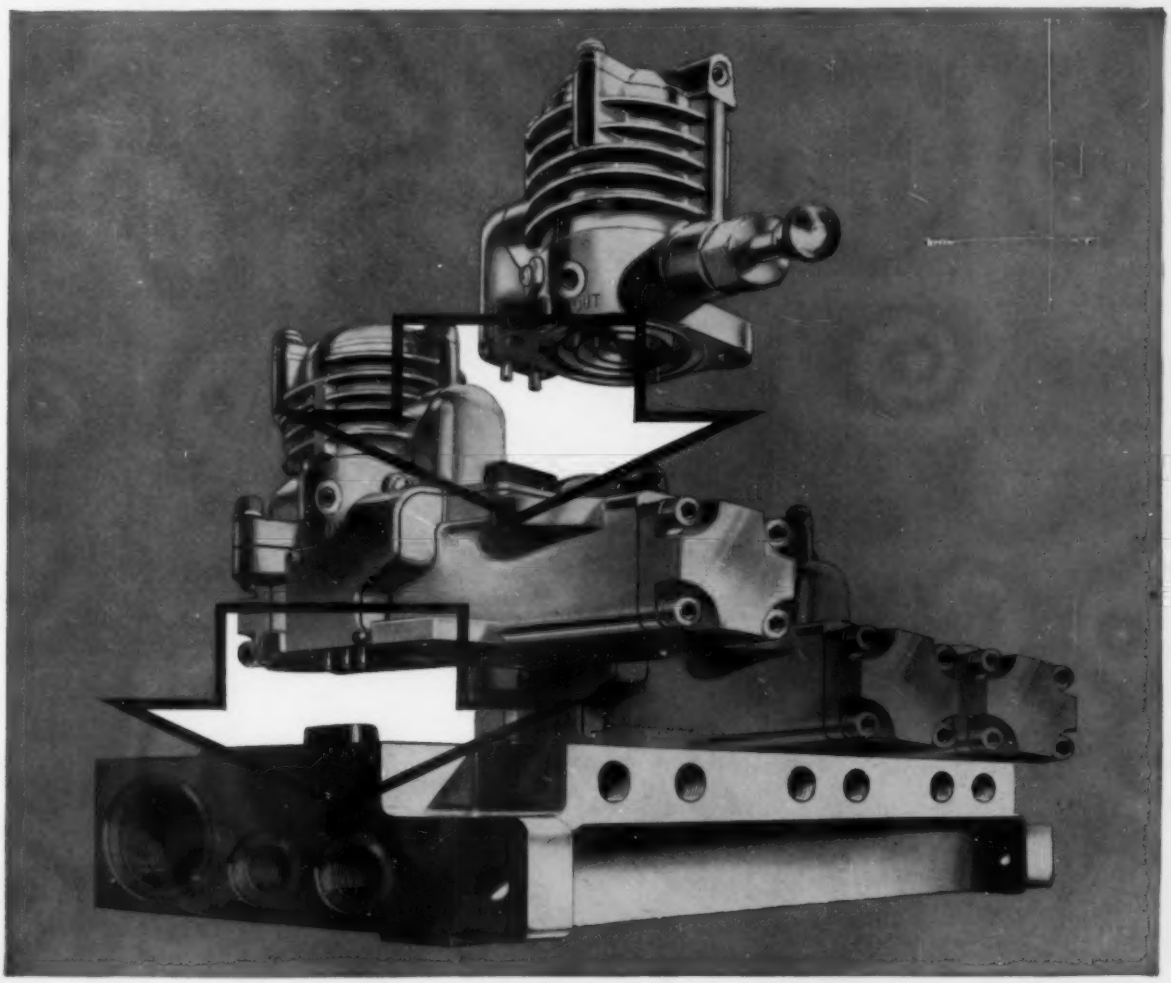
And, compact size, peak performance plus multi-million cycle dependability, assured by aluminum and stainless steel components . . . coil guaranteed against burn-out for life of valve . . . manifold, sub-base or foot mounting—single or double solenoid . . . JIC pilots . . . 35—200 psi range . . . ¼ in. NPT ports . . . coils for ac or dc, any voltage . . . optional manual over-ride . . . all are yours with ¼ in. Speed Kings!

Put these advanced-design valves to work on your machines . . . their performance and economy will amaze you! Valvair Corporation, 454 Morgan Ave., Akron, Ohio. AA-5098

Multiple manifold mounting; 3 station shown, 2 station available. Conduit port, 1¼ in. NPT; common inlet and exhaust ports, ½ in. NPT; cylinder ports, ¼ in. NPT. Manifolds may be ganged for installation of any number of valves. Sub-base and foot-mounted valves also offered.



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1957 FLUID POWER PRIZE PAPER CONTEST

CONTEST CLOSES JULY 1, 1957

First Prize $500

Second Prize $300

Third Prize $200

4th to 7th Prizes, each . . $50

CONTEST RULES

PURPOSE: The purpose of this competition is to recognize and reward achievement in the field of fluid power design and application.

SUBJECT OF ENTRIES: Papers can deal with any phase of product or equipment development in the fluid power field; descriptions of new applications of hydraulics and pneumatics; efficient maintenance and trouble shooting programs; construction techniques used on fluid powered machines; production and automation improvement obtained by use of fluid power; circuit improvements; machine conversions.

All papers must be original and expressly prepared for entry in this contest.

Papers may be co-authored.

Where required, company clearance for publication must be obtained by the author before submitting the paper.

WHO MAY ENTER: All readers of APPLIED HYDRAULICS Magazine whose work has helped to promote the advancement of hydraulics or pneumatics are eligible.

CRITERIA FOR AWARDS: Judges will evaluate papers on the basis of practicality, economics, originality, and presentation for publication.

HOW TO ENTER: Papers must be typed, double-spaced, on 8½ x 11 sheets. Inclusion of glossy photographs is recommended along with pertinent circuit, layout, and component drawings.

Drawings should be prints or photostats.

Where applicable, tables, charts and graphs should be included.

Papers must be submitted in duplicate.

On the title sheet for each entry, author's name, position, company and address must appear.

There is no limit to length of article. Any issue of APPLIED HYDRAULICS will serve as a guide to presentation.

Submit all entries to:

Editor
APPLIED HYDRAULICS Magazine
812 Huron Road
Cleveland 15, Ohio

PRESENTATION OF PRIZES: As in past years, arrangements will be made to present cash awards to the three top winners at a luncheon meeting of the National Conference on Industrial Hydraulics in the Fall of 1957. The three top papers will be published in the APPLIED HYDRAULICS Conference Issue, October 1957.

STATUS OF SUBMITTED PAPERS: All papers winning cash prizes and awarded honorable mention become the property of APPLIED HYDRAULICS Magazine to be scheduled for publication by its editors. After publication, permission for reprinting or presentation before technical groups will be granted.

All entries will be acknowledged.

CLOSING DATE: July 1, 1957

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